WARMLY DEBATED:

THE LITTLE ICE AGE

AND

THE CONSTRUCTION OF HISTORICAL CLIMATIC REGIMES, 1650-1950

A Thesis

by

CHRISTOPHER RYAN GILSON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

May 2010

Major Subject: History

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ABSTRACT

Warmly Debated: The Little Ice Age and the Construction of Historical Climatic Regimes, 1650-1950. (May 2010)

Christopher Ryan Gilson, B.A., Northwestern State University of Louisiana

Chair of Advisory Committee: Dr. Chester S. L. Dunning

Climatic change has been the subject of investigation and spirited debate for more than three centuries. One important element of this debate has been the search for and definition of unique, impermanent climatic regimes measurable by historic time. The Medieval Warm Period and the Little Ice Age are the two most commonly referenced and discussed of such regimes. This thesis examines the theories and debates that preceded and surrounded the formal definition of the Little Ice Age as an historic period of approximately 1550-1850 AD.

This thesis begins by describing early attempts to measure and record climatic conditions during the late seventeenth and early eighteenth centuries while also demonstrating that climatic change and climatic influence were matters of concern for both the scientific and philosophical elite and the public. By the first decade of the nineteenth century, however, discussion of climatic change had begun to center on comparisons of the medieval past and the cooler present. Climatic change itself often intruded on debates about past climates during the early nineteenth century. By 1900, however, both scholars and laymen had begun to recognize that some form of climatic

change had occurred in the sixteenth century. Early twentieth century scholars such as Otto Pettersson, Charles Rabot, and Ellsworth Huntington helped define the boundaries and significance of historical climatic regimes. When François Matthes wrote of a “little ice-age" in 1939, he was not creating a wholly new idea; he was instead engaging in a centuries-old debate over the climatic conditions of the last millennium.

DEDICATION

To my parents

ACKNOWLEDGEMENTS

Historians are often imagined to pursue a solitary trade. They are lone adventurers, pen and pad in hand, who dive into the mysteries of the archive and emerge, battered, with a new perspective of the world for which they alone are responsible. At our best, we may be so glamorous, but none of us could accomplish the things we do without the invaluable assistance of colleagues, friends, and family. I am no exception. I would never have stumbled upon this subject—or found my way through it—without the direction of my committee chair, Dr. Dunning, and the members of my advisory committee, Dr. Adams, Dr. Dawson, and Dr. Hugill. I thank them wholeheartedly for their advice and assistance, both in this project and in others.

I also thank the faculty and staff of the Department of History for their kindness and support in the pursuit of my studies. My fellow graduate students are one of the department's greatest features, and I truly appreciate my time with them in College Station. Many good ideas are uncovered by accident, at unexpected times, and I count our many informal conversations as both recreation and resource.

My ability to complete this and any other project in history has been immeasurably aided by the instruction and advice I received in pursuit of my Bachelor of Arts degree at Northwestern State University of Louisiana in Natchitoches. To each member of the Department of History and School of Social Sciences, I express my appreciation. Many of my fellow graduates from the Department of History have also

gone on to pursue graduate studies in history. I appreciate their encouragement and support in the completion of this project and wish them the best in their own studies.

Librarians and archivists are often the unsung heroes in the pursuit of historical research. I will never know the names of the vast majority of the people who collected, protected, and, more recently, digitized the sources that served as the foundation for this study, but I thank them nonetheless. I am especially thankful for the assistance of Jackie Hawkins at Northwestern State University's Watson Library in Natchitoches, Louisiana, and of Dorothy Fernandez and Paula Craig at the Northwestern State University College of Nursing library in Shreveport, Louisiana. When other libraries were unable to track down a copy of a particularly hard-to-find text, they found a way. I am grateful for their assistance.

Finally, I must express my profound appreciation for the support of my parents, Gil and Kay Gilson. The best portions of this thesis were written on their patio during the summer of 2009, and they have read this manuscript almost as many times as I have. My gratitude for their love, support, and encouragement cannot be measured in numbers nor expressed in words, but I offer it all the same. Thank you.

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CHAPTER I

INTRODUCTION

Climatic change has garnered significant attention in the West since the 1970s. Does the climate change systematically or randomly? What evidence is there of such change? Why does it change? How does climatic change affect society? Such questions have continued to appear with increasing frequency in both the developed and the developing world. While much of the initial attention provided the subject in the 1970s was concerned with the potential emergence of a new ice age, subsequent years have focused primarily on the measured warming of the globe. The intensity of the present debate over "global warming" and "climate change" has itself done much to popularize meteorology and climatology, disseminating hypotheses and theories to audiences far removed from their formulation. As scientists, citizens, and environmental activists have addressed and debated the aforementioned questions, social scientists and historians have sought to apply them as a tool for better understanding both long and short-term historical causation. Bookstore shelves are a testament to the efforts of those who have applied these tools and to the public's receptivity to their work. Prominent authors Jared Diamond and Brian Fagan have between them five books focused on the

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This thesis follows the style of *Central European History*.

relationship between society and its variable environment.[1] Media ranging from college textbooks to television documentaries have given such authors easy access to the public ear, and their assertions, while sometimes controversial, have gained a wide audience. While Diamond and Fagan have probably exposed the largest number of readers to the potential impact of climatic change, they were not the first to engage the subject. The question of the historical significance of climatic change has a long and largely forgotten bibliography: its influence has been suggested, questioned, dismissed, measured, accepted, and—always—debated for the better part of three centuries.

Arguments for the existence of unique, impermanent climatic regimes have been a central theme of past and present climatic investigations. The two most famous climatic regimes have occurred in the last millennium. In current terminology, they are the Medieval Warm Period (or Medieval Climatic Optimum) from approximately 900 to 1300 and the Little Ice Age from 1300 to 1850—or 1550 to 1850, depending on the author. This thesis focuses primarily upon the better-documented Little Ice Age and traces how it came to be identified as a distinct era worthy of a proper name and its own historiography. Due to the close relationship between the two roughly neighboring eras, however, the idea of medieval warmth has never been far-removed from discussions of post-medieval cooling.

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[1] Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed* (2005; repr., New York: Penguin Books, 2006); Brian Fagan, *Floods, Famines, and Emperors: El Niño and the Fate of Civilizations*, rev. ed. (1999; New York: Basic Books, 2009); idem, *The Little Ice Age: How Climate Made History, 1300-1850* (2000; repr., New York: Basic Books, 2002); idem, *The Long Summer: How Climate Changed Civilization* (2004; repr., New York: Basic Books, 2005); idem, *The Great Warming: Climate Change and the Rise and Fall of Civilizations* (2008; repr., New York: Bloomsbury Press, 2009).

Although historians only began incorporating, explicitly, the Little Ice Age into their narratives after the 1960s, the label itself is generally traced to the 1930s. While there remains some debate about the term's early usage, it is generally accepted that American geologist François Matthes first used it in 1939 in an annual report of the American Geophysical Union's Committee on Glaciers, which he chaired. Matthes applied the term "little ice-age" to a period consisting of the preceding 4,000 years. Although he placed the name in quotation marks, he did not capitalize it. Contemporary histories of the Little Ice Age rarely proceed beyond these basic facts, if they discuss its theoretical origins at all.

Jean Grove, one of the foremost scholars of the subject, published in 1988 one of the first books dedicated to the Little Ice Age. Grove did discuss the origins of the term Little Ice Age, acknowledging that one of the "main objections" to the idea of the era has been "that the term was originally applied to a quite different time period."[2] Grove briefly addressed this objection, noting that "Matthes was well aware of the record of repeated glacial advances in Europe during the past 400 years."[3] Grove's limited acknowledgement of the complexity of the term has largely escaped the attention of other analyses. Philip Jones and Raymond Bradley suggested in 1992 that the "term originated with Matthes" and was "informal (not capitalized)."[4] Jones and Bradley did,

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[2] Jean Grove, *The Little Ice Age* (London: Methuen, 1988), 3.

[3] Ibid., 4. Routledge published an expanded edition of this volume sixteen years later. This publication has yet to reshape the discussion of Matthes. See Jean Grove, *Little Ice Ages: Ancient and Modern* (New York: Routledge, 2004), 1:3.

[4] Philip D. Jones and Raymond S. Bradley, "Climatic variations over the last 500 years," in *Climate Since A.D. 1500*, ed. Raymond S. Bradley and Philip D. Jones (London: Routledge, 1992), 658.

however, acknowledge that Matthes recognized the three centuries preceding his work as the period of the greatest advance of glaciers in several millennia. While they noted that it was "this latest and most dramatic episode of neoglaciation to which the term 'Little Ice Age' is now generally applied," they did not seek to explain why the term gained such a new application.[5] Philip Jones, Astrid Ogilvie, Trevor Davies, and Keith Briffa suggested in 1998 and 2001 that "the advances and retreat of glaciers have been used for the last 80 years as evidence of past climatic change," and they found it "worth noting" that Matthes' definition "applied to the entire period of the past 4,000 years."[6] In one of the best-selling books on the Little Ice Age, Brian Fagan contended that "Matthes used the term in a very informal way, did not even capitalize the words and had no intention of separating the colder centuries of recent times from a much longer cool, wet period that began in 2000 B.C." [7]

Ogilvie, with Trausti Jónsson, weighed in on the terminology of the Little Ice Age once more in 2001. They emphasized the dissimilarity between Matthes' usage of the term and that of the present, describing it as "very different."[8] Ogilvie and Jónsson characterized Grove's analysis of the term as "detailed" and attempted to explain how it came to be applied to the early modern world—while largely ignoring the publications

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[5] Jones and Bradley, *Climate Since A.D. 1500*, 658.

[6] Philip D. Jones et al., "Unlocking the Doors to the Past: Recent Developments in Climate and Climate Impact Research," in *History and Climate: Memories of the Future?*, ed. Philip D. Jones et al. (New York: Kluwer Academic, 2001), 3. This book was based upon the proceedings of the *Second International Climate and History Conference*, 1998.

[7] Fagan, *The Little Ice Age*, 48.

[8] Astrid E. J. Ogilvie and Trausti Jónsson, "'Little Ice Age' Research: A Perspective from Iceland," *Climatic Change* 48, no. 1 (2001), in *The Iceberg in the Mist: Northern Research in Pursuit of a "Little Ice Age,"* ed. Astrid E. J. Ogilvie and Trausti Jónsson (Dordrecht, The Netherlands: Kluwer Academic Publishers, 2001), 10.

of the 1940s and 1950s.[9] They suggested that the Little Ice Age, in both of its usages, was "a mid-twentieth-century construction."[10] It gained its title of "ice age," they speculated, as "climatologists and palaeoclimatologists in the early and middle part of the twentieth century" who "concentrated on unraveling the details of the climate of the recent past" found it "tempting to compare what they perceived to be an interesting phenomenon with a similar episode (albeit of greater magnitude) in the past."[11]

Taking such scholars at their word, these basic criticisms may seem to have some validity. Decades after the inception of the name "little ice-age," the term seemed to appear *sui generis*, and bearing a new definition, in works of history and climate. The Little Ice Age would seem, to many, to be an ill-defined concept with a short but checkered past. Although this error is forgivable, nothing could be farther from the truth. In the first place, a clear misunderstanding exists regarding Matthes' initial usage of the term; the variety of interpretations addressed above offer ample evidence of this. Matthes' own ruminations on the "little ice-age"—scattered throughout books, articles, and multiple committee reports—were far more nuanced than most scholars have acknowledged. It is also important to recognize that Matthes' contemporaries wasted little time in applying his terminology to the early modern era; scholarly adoption of the term "little ice-age" was a product of the 1940s rather than the 1960s. Historians have little patience for speculation not grounded in source material, and Ogilvie and Jónsson's speculation that the post-medieval definition of the Little Ice Age was a twentieth-

[9] Ibid., 10.
[10] Ibid., 12.
[11] Ibid., 10.

century construction demands further investigation. The discussion of climatic periodization did not begin with the awarding of proper titles; it has been the subject of written discourse for more than two millennia. This vast corpus of history, geography, and science offers ample evidence that the idea of the Little Ice Age as a uniquely definable period preexisted its naming by almost a century.

The present research analyzes popular and scholarly sources published between the mid-seventeenth and mid-twentieth century. These chronological limits have been established for both technical and philosophical reasons. English publications on climate are most readily available for the period beginning after the mid-seventeenth century, which is not surprising considering that these early English publications were among the first to recommend a standardized system for widespread measurement of climate. By the end of the 1940s, the Little Ice Age—as a distinct, post-medieval, historical period—had been established in scholarly texts. As such the decade provides a sound endpoint for analysis of the idea's development. The three-hundred years discussed here are divided into five chronological chapters, but their assigned dates and titles should be interpreted as suggestive rather than definitive. Historical and scientific debates surrounding climatic change have rarely followed a clear progression and have often defied categorization. The source material does, however, lend itself to the basic structure suggested by the chapters that follow.

The source materials utilized here consist primarily of published books and professional journals of British and American origin. Selected French, Swiss, Canadian, German, and Swedish sources also make valuable contributions. Because of the nature

of this research, with its emphasis on when and how ideas about the Little Ice Age emerged, the sources upon which this narrative is based are diverse. Although the assertions of some of the most important figures of philosophy, history, geography, and geology—David Hume, Edward Gibbon, Ellsworth Huntington, and François Matthes, respectively—will be addressed in this project, so too will the comments and recollections of farmers, beekeepers, and mountaineering reverends.

This essay takes as its purpose the contextualization of the "Little Ice Age." Ideas about climatic change and climatic influence had been an important element of natural philosophy for several hundred years before scientists and historians began applying formal names to ideas and ages. This sphere of ideas, hypotheses, theories, and philosophies of climate will be designated here, for the sake of clarity, as "climate theory." This should not be interpreted as a suggestion that *all* theorists shared the same theory. Instead it should be understood that that all who wrote about the climate engaged similar questions and problems—even if they did not all approach the subject from the same perspective or reach the same conclusion. Climate was more than a natural phenomenon; it was also an important locus for scientific, historical, and philosophical debate. It remains so today. The idea of the "Little Ice Age" was and continues to be a product of such debates.

While the primary aim of this essay is to contribute to a better understanding of the history of the Little Ice Age by exploring the ideas from which it developed and the circumstances surrounding its naming, satisfaction of this allows for the exploration of several important questions. One of the central problems of the identification of

historical climatic regimes has long been the question of extent: when does one begin, and when does it end? While this project offers no final answer to this difficult question, it does augment the present understanding of the era's chronology by exploring where theoreticians of the past placed their beginning and endpoints. It also engages the question of whether understanding of the environment progressed uniformly, as some might wish to think, or whether its history has been marked by numerous interruptions and retractions. The wide spectrum of sources examined offers insight into society's valuation and engagement of climatic change, while also allowing for a better understanding of the interaction between "new" and "old" ideas within the developing spheres of historical and scientific debate.

Climatic change has been a subject of concern for humans for as long as they have been capable of comprehending it on some basic level. The narrative traced by the following chapters seeks to engage the eternal relationship between Man and Nature by considering the means by which people have categorized and explained their native climates. This research aims to contribute to the work of professionals outside of History, from Philosophy and Geography to Geology and Climatology, for their contributions to History have been great, indeed. Climate has never been the intellectual property of any one discipline, though, and it is hoped that citizens, policy-makers, and activists on all sides of the "climate change" debate will also find something of value here. Historians, geographers, and geologists have long recognized that the climate undergoes some form of change, even if accord has never been one of this discussion's prominent characteristics. This narrative seeks to restore to these largely forgotten

figures a voice and to allow them once again to engage a subject which remains, in the memorable words of Ellsworth Huntington, “warmly debated.”[12]

[12] Ellsworth Huntington, *Civilization and Climate* (New Haven: Yale University Press, 1915), 222.

CHAPTER II

EARLY MODERN INTERPRETATIONS OF CLIMATE

Mankind has long sought to better understand its present environmental circumstances in light of evidence from the past, be it mythological or historical. Philosophers, historians, and practitioners of the nascent sciences have sought, for millennia, to determine whether conditions are dynamic and whether they have had a measurable impact on the experience of life. That this narrative takes as its theme the consideration of early modern Europe and America is due rather to the limitation of space and time rather than to any inherent disregard of prior periods or other regions. Although ancient writers understood the climate in a different way from those of the recent past, they were clearly aware of the necessity of defining the relationship between nature and society, while also recognizing, in some cases, that the climate has undergone great changes. Herodotus, Hippocrates, Aristotle, and Polybius all participated in these early analyses of the climate. For the Greeks, however, "climate" referred not to a given set of characteristics but rather to a unique region, one which may not have had, in truth, unique characteristics. It was a geographical, rather than geological, concept. George Costard, in a 1767 history of astronomy, succinctly explained this ancient understanding, contending that it meant "a tract on the surface of the Earth, included between two

parallels of latitude, where the length of the longest day in one, exceeds the longest day in the other, by half an hour."[1]

Although natural conditions had been a subject of extensive discussion in the ancient world, it would not be until the early modern era that the study of climate would again approach levels of organization and development comparable to the most accurate works of ancient theoreticians. The world of the Scientific Revolution and the Enlightenment, in conjunction with development in methods of manufacturing, provided a uniquely fruitful environment for the expansion and maturation of climatic studies. The printing press, the increasingly widespread availability of scientific instruments, and the Scientific Revolution's high valuation of observation and organization immeasurably aided in the discipline's development. Historian Jan Golinski has suggested that this period, identifiable by its multitudinous references to weather in diaries and by the compilation of dedicated weather diaries may be "understood as part of the large-scale enterprise of 'civilizing nature.'" This was an "attempt to assimilate features of the natural world within the practical and conceptual framework of civil society." Golinski identified two aspects of this development that are central to understanding the history of meteorology: the formation of learned "groupings of autonomous individuals who directed their activities toward public goals" and the increased "traffic between the

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[1] George Costard, *The History of Astronomy, With its Application to Geography, History, and Chronology; Occasionally Exemplified by the Globes* (London: Printed by James Lister, 1767), 4.

language used to describe humanity and that applied to the natural world."[2] Nature, like society, was expected to be subject to observable, delineable laws. Within this intellectual milieu the first modern methods of observation and categorization were developed.

Widespread recognition of the value of collecting records on the climate became particularly apparent by the mid-seventeenth century. By the end of the century, some were taking tentative steps in a new direction, concerning themselves not only with *knowing* the conditions of the present, but also in seeking information in history for *comparison* with the present. Neither approach should be seen as more valuable than the other; in the end a combination of both efforts—measuring the present and scouring the archives—would be needed to comprehend climatic conditions and changes. Those who participated in this venture—through either approach—certainly included weather diarists who recorded daily measurements, but they were joined by others who were simply curious about the environment in which they lived.

One of the first important publications in this new process of systematically measuring environmental conditions was Thomas Sprat's *History of the Royal Society*, published in 1667. Sprat's volume made two important contributions to climatic thought. The first of these was the inclusion of a brief article by Robert Hooke which

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[2] Jan Golinski, "Putting Weather in Order: Narrative and Discipline in Eighteenth-Century Weather Diaries" (paper presented at the William Andrews Clark Memorial Library, UCLA, Los Angeles, CA, May 16, 1998), http://www.unh.edu/history/golinski/paper3.htm (accessed June 27, 2009).

outlined a method for "the better making" of "a History of the weather."[3] Hooke identified eight characteristics that he believed ought to be observed and recorded: the "Strength and Quarter of the Winds," the "Degrees of Heat and Cold in the Air," the "Degrees of Dryness and Moisture in the Air," the "degrees of Pressure in the Air," the "constitution and face of the Sky or Heavens . . . [as seen] by the eye," the presence of illness or disease, the occurrence of "Thunders and Lightnings," and "[a]ny thing extraordinary in the Tides."[4] These, Hooke contended, "should all or most of them be diligently observed and registered by some one, that is alwayes conversant in or neer the same place."[5]

For some of these measurements, Hooke offered instructions for the construction and best usage of necessary instruments. He even suggested a standardized table for the recording of this data. The instructions he offered for this table were anything but vague: "[Allow] fifteen dayes for one side, and fifteen for the other. Let each of those pages be divided into nine Columes, and distinguished by perpendicular lines; let each of the first six Columes be half an inch wide, and the three last equally share the remaining of the side."[6] Hooke also defined the manner in which each column ought to be titled, and he included within his article a guide to terms that might be used to describe conditions. For example, he explained how one might describe the conditions of the

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[3] [Robert] Hook[e], "A Method For making a History of the Weather," in *The History of the Royal Society of London, For the Improving of Natural Knowledge*, ed. Tho. Sprat (London: Printed by T.R. for J. Martyn, 1667), 173.

[4] Ibid., 174-75.

[5] Ibid., 175.

[6] Ibid., 175-76.

sky: "let *Cleer* signifie a very cleer Sky without any Clouds or Exhalations."[7] Such strict methodology strongly suggests Hooke's participation in the venture of "civilizing nature," but it also likely served as encouragement for others to measure more than merely temperature or moisture, as doing so would leave much of the prepared form bare—a most unenlightened dereliction of scientific duty. Hooke's hope was that the system outlined in his article, or one similar to it, would be adopted across an extensive area. He "wisht that there were divers in several parts of the World, but especially in distant parts of this Kingdom, that would undertake this work, and that such would agree upon a common way somewhat after this manner," that "the same method and words might be made use of." The benefit of such a mission, within such methodological restraints, he wrote, was "easily enough conceivable."[8]

Despite the (now) obvious utility of Hooke's meteorological system for the formation of historical chronologies and narratives, Hooke made little reference to the future usage of his collected data. "As for the Method of using and digesting those so collected Observations," he concluded his article, "[t]hat will be more advantageously considered when the *Supellex* is provided; A Workman being then best able to fit and prepare his Tools, for his work, when he sees what material he has to work upon."[9] The only suggestion that Hooke offered for the future utility of such observations fell, again, within the category of "civilizing nature." He contended that the data from the eight observations "may be registred so as to be most convenient for the making of

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[7] Ibid., 177.
[8] Ibid., 178.
[9] Ibid.

comparisons, requisite for the raising *Axioms*, whereby the Cause or Laws of Weather may be found out."[10]

Later in *The History of the Royal Society*, as part of a concluding section, Sprat took a moment's break from the impersonal narrative he idealized to call attention to the overlooked contributions of one of the Royal Society's members, Dr. Christopher Wren. In doing so Sprat brought additional attention to the difficulties accompanying attempts of natural history. Following a brief discussion of Wren's "Doctrine of Motion," Sprat discussed the "Second *Work* which he has advanc'd," the "*History* of *Seasons*." Such an endeavor, Sprat asserted, "will be of admirable benefit to Mankind, if it shall be constantly pursued, and deriv'd down to *Posterity*."[11] Sprat's discussion of Wren's accomplishments is largely limited to a description of his material—rather than theoretical or historical—contributions. This may, however, be a result of Sprat and his colleagues' caution in the face of explaining the seemingly unexplainable—Nature. In an apology in response to the Society's critics, Sprat wrote that "[i]f any shall yet think they have not usefully employ'd their time, I shall be apt to suspect, that they understand not what is meant by a *diligent* and *profitable labouring* about *Nature*."[12] This labor remained, then, in its infant stages. The society's members went "leisurably on; but their

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[10] Ibid., 175.

[11] Sprat, *History of the Royal Society*, 312.

[12] That this comment was directed at the Society's critics, and served as an apology, is clearly indicated on the unnumbered second page of the book's opening "Advertisement to the Reader": " The style perhaps in which it is written, is larger and more contentious than becomes that purity and shortness which are the chief beauties of Historical Writings : But the blame of this ought not so much to be laid upon me, as upon the Detractors of so noble an Institution : For their Objections and Cavils against it, did make it necessary for me to write of it, not altogether in the way of a *plain History*, but sometimes of an *Apology*."

slowness [was] not caus'd by their idleness, but care." They had, Sprat suggested, "contriv'd in their thoughts, and couragiously begun an *Attempt*, which all *Ages* had despair'd of." Because of the novelty of this enterprise, "the nature of their *Work* requir'd that they should first begin with *immethodical Collections* and *indigested Experiments*."[13] That this undertaking was not explicitly contextualized, again, did not trouble Sprat. His fellow members were to remember that "the *Subject* of their *Studies*" was "as large as the Univers," and their "Method . . . may well be justified, seeing they have the *Almighty Creator* himself for an *Example:* For he at first produc'd a confus'd and scatter'd Light; and reserv'd it to be the *work* of another day, to gather and fashion it into beautiful *Bodies*."[14] An exhortation of this degree suggests that the society's initial attempts at explaining Nature were not well-received by all. That the Society deemed it important to proceed methodically, if slowly, in the pursuit of meteorological knowledge offers much in defense of their adherence to the scientific principles of the Enlightenment.

Contemporaneous with the rediscovery of Nature as an observable, measurable, and categorical entity was an increased willingness to draw comparisons of climatic conditions across time rather than merely space. A treatise on the United Provinces written in 1671 offers a rather thoughtful discussion of the nature of the climate; it is a discussion that is undeniably informed by the study of history. Author William Aglionby, also a Fellow of the Royal Society, found it difficult to categorize the Dutch

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[13] Ibid., 318.
[14] Ibid., 318-19.

climate. He wrote that "the Air is pretty well tempered in *Holland*, though cold do a little predominate, there being continual winds and frequent rains," but he nevertheless concluded that "the inconstancy of the Climate is such, that the seasons seem to be in a perpetual confusion."[15] Seeking to make sense of a climate where "the heat is never violent" and "the cold is seldome lasting," Aglionby turned to two sources. First, he sought traditional wisdom, noting that, as the proverb says, "*rigorous masters do not govern long*."[16] Finding that explanation inadequate—and noting that every rule has its exception—Aglionby hastened to add that there had been "long and hot Summers, and violent cold lasting Winters," such as those of the year 1149. He attributed this discovery to his investigation of the Annals of the Netherlands.[17]

While authors like Hooke, Sprat, and Aglionby participated in the rediscovery of climate as a subject worthy of study and categorization, others participated in a debate on the degree of influence climate maintained on individuals and societies. It had grown popular, in the preceding decades, to give to climate authority over many aspects of

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[15] [William Aglionby], *The Present State of the United Provinces of the Low-Countries as to the Government, Laws, Forces, Riches, Manners, Customes, Revenue, and Territory of the Dutch*, rev. ed. (London: Printed by John Starkey, 1671), 216.

[16] Ibid., 217.

[17] Ibid., 217-18. The Dutch certainly seemed well-adjusted to such cold weather in Aglionby's era, to judge by his account of their winter diversions on pages 217-18: "When the Chanels are frozen, they slide upon them with a certain sort of Shooes called *Skates*, which have a long, shining, narrow, crooked Iron, that stands out before. They that are perfect in this exercise turn their Feet inwards, that the Iron may take the more hold of the Ice, upon which they fly like Birds in the air with that swiftness, that one can hardly follow them with the eye. The Women too use this as a diversion, and many do very pretty tricks upon the Ice, but most are content with a straight course, as much as needs to get heat and ground. Every Sunday after Sermon all the people of the Towns come out upon the Ice, some to slide and others to look on. I knew a young Clown of ten years old, who did brag *that he had gone eighteen miles or six leagues in an hour* upon his Skates. The same laid a Wager with a Peasant his neighbour, that he would sooner slide three leagues, than the other should ride one and a half with the best Horse he should get. It is ordinary for these sort of people to go from *Leyden* to *Amsterdam* in an hour and a quarter, if the Ice be even, and yet that is near eighteen miles."

human life. This idea of climatic determinism, often referred to in the present as environmental determinism, suggested that environmental factors were the sole or leading agents in the course of events. Some writers, however, encouraged the slow unraveling of this traditional garb of climate as a marker for defining the civilized and beastly zones of the globe. This debate has remained a central element of historical and ecological debates. During the seventeenth century, attempts by natural philosophers and historians to distance themselves from absolute climatic determinism were uniquely important because of the impact these attempts had on recognizing the complexity of the natural world. It signified an important stage in the transition from a mythological understanding of climate to one of a more scientific persuasion. Though this transition is not the central question of the narrative at hand, it is an important aspect of the growing trend toward observation and classification of climate.

Gabriel Dellon's late seventeenth century work on the subjects of travel and disease *en route* to and in the East Indies is illustrative of the early stages of this transition. Dellon argued that "Nature performs its operations in all parts of the World, according to its primitive Fundamental Laws, that the Heats and Colds of these several Climates differ only in degrees, and that the Monsters of Africa or the Indies, are no more surprising to the Inhabitants of these parts, than the Beasts that are commonly seen and bred among us are to the Europeans."[18] Although Dellon's understanding of disease

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[18] Gabriel Dellon, *A Voyage to the East-Indies: Giving An Account of the Isles of Madagascar, and Mascareigne, of Suratte, the Coast of Malabar, of Goa, Gameron, Ormus, and the Coast of Brasil, with the Religion, Manners and Customs of the Inhabitants, &c. as also a treatise, of the Distempers*

was far from accurate—he seemed to maintain a sense that *people* were different in different climates, observation of the natural world served to shake even this belief. He discovered, to his great surprise, that the Indies suffered from smallpox in much the same way as did Europe. Dellon wrote that, although "one might suppose" it "to be less dangerous in a Climate, where the Pores of our bodies being always open, consequently facilitate the Expulsion of the venomous Matter," the disease made "worse havock [in the Indies] than in *Europe*."[19]

John Fryer's account of East-India and Persia, compiled over the course of the second half of the seventeenth century, awarded climate a far more deterministic role. The place of disease in this equation was given a fairly typical station: death and suffering were the ever-present companions of life in such a region. Describing life in the environs of Bombaim, Fryer noted that, for all the people's "Gallantry, I reckon they walk but in Charnel-houses, the Climate being extremely Unhealthy." Fryer's explanation for this suffering is difficult to decipher, but the necessity of the climate in the formulation of his worldview is undeniable. Fryer credited "Situation," which caused an "infecundity in the Earth, and a Putridness in the Air," which prevented produce from reaching maturity.[20] Fryer's appreciation for the significance of climate is

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peculiar to the Eastern Countries, trans. J[odocus] C[rull] (London: Printed for D. Browne, 1698), unpaginated preface.

[19] Ibid., 243.

[20] John Fryer, *A New Account of East-India and Persia, in Eight Letters. Being Nine Years Travels, Begun 1672. And Finished 1681. Containing Observations made of the Moral, Natural, and Artificial Estate of Those Countries: Namely, Of their Government, Religion, Laws, Customs. Of the Soil, Climates, Health, Diseases. Of the Animals, Vegetables, Minerals, Jewels. Of their Housing, Cloathing, Manufactures, Trades, Commodities. And of the Coins, Weights, and Measures, used in the Principle Places of Trade in those Parts* (London: Printed by R. R. for Ri. Chiswell, 1698), 68.

further supported by his attempt to "vindicate" Persia, "famous for so many Ages past, from the Barbarity of the rest of the *Eastern* Nations." Fryer understood the contemporary characteristics of the society as a reflection of their climatic circumstances rather than of their ancestry. The "Place" had "transmitted some of its Civility . . . through the repeated Alterations of Fortune, to the present Possessors, who were originally of a morose Extract." They had "put off their Native Ferity," Fryer suggested, to "comply with the over-ruling influence of the Climate."[21]

Not all seventeenth century theorists, however, subscribed to environmentally deterministic theories. Examples abound of those who maintained alternative perspectives. Richard Bentley, in a series of sermons he gave and published in the 1690s, had no patience for those who placed the blame for sinfulness on climatic situation. Bentley's condemnation of climatic determinism was both direct and historically-minded. He noted that "in some Countries Intemperance is a necessary part of Conversation," but "in others Sobriety is a Vertue universal, without any respect to the Duties of Religion." Despite this evidence of variety, Bentley contended that one ought not believe "that this is only the difference of Climate, that inclines one Nation to Concupiscence and Sensual Pleasures; another to Blood-thirstiness and Desire of Revenge." It would "discover great ignorance in History," he explained, "not to know

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[21] Ibid., 402.

that in all Climates a whole People has been over-run with some recently invented or newly imported kind of Vice, which their Grandfathers never knew."[22]

William Aglionby's aforementioned foray into the historical investigation of climate was not a solitary venture. In a 1705 essay on the natural history of Oxfordshire, partly written in 1675, Robert Plot noted that the county had probably experienced some tempests with "deplorable Effects." He could not support this suggestion with evidence, however, as their effects were "no where transmitted to Posterity."[23] Seeking to fill this lacuna, at least for the present, Plot described two storms of unusual intensity that had occurred during the 1660s. As for the tempests that had preceded and followed these two, Plot admitted that, though he had not always been "so curious in those days to observe," it might now "be wish'd . . . that some old Almanacks were written instead of New." Plot hoped that, "[i]nstead of the conjectures of the Weather to come," some "ingenious and fit Persons would give a faithful account from divers parts of the World, not only of the Storms, with the antecedents and consequents of them, but of the whole Weather of the Years past, on every day of the Month." An extensive record such as this would allow for better predictions of future disasters and for better determining the means by which their impact might be mitigated, through "remedies, or prevention."[24]

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[22] Richard Bentley, "The Folly of Atheism, And (what is now called) Deism: Even with respect to The Present Life. The First Sermon preached March 7 1691/92," in *The Folly and Unreasonableness of Atheism Demonstrated from The Advantage and Pleasure of a Religious Life, The Faculties of Humane Souls, The Structure of Animate Bodies, & The Origin and Frame of the World: In Eight Sermons*, 4th ed. (London: Printed by J.H. for H. Mortlock, 1699), 29.

[23] Robert Plot, *The Natural History of Oxford-shire, Being an Essay towards the Natural History of England*, ed. Robert Brown, 2nd ed. (Oxford: Printed by Leon. Lichfield, for Charles Brome, 1705), 4.

[24] Ibid., 6.

These observations, Plot believed, if regular rather than random, and if drawn from local as well as "foreign and remote parts," might allow for the development of "true Investigations of Heats and Colds, and of the bredth and bounds of coasting Rains and Winds."[25]

While many of the preceding authors directly addressed climate, few addressed concerns about climatic change—at least in the sense that it would later be understood, as an alternation between periods of greater and lesser warmth. Climatic change was a matter of concern, though, and even intruded upon religious debates about such important matters as the baptism of infants. The first two decades of the eighteenth century saw a lengthy debate between proponents and opponents of the practice, maintained through articles, histories, and reviews. One of the central figures in this debate was William Wall, the Vicar of Shoreham in Kent, whose 1705 (and 1707) *History of Infant Baptism* addressed historical positions on the subject.[26] It also initiated quite a debate in its own right, with climatic change an important element of subsequent critical and defensive publications. John Gale offered the most extensive criticism of Wall's work, publishing in 1711 *Reflections on Mr. Wall's History of Infant-Baptism*. In this series of letters, Gale explained that one of the growing reasons for the abandonment of baptism-by-submersion was concern over the coolness of the climate:

> I am necessitated humbly to take notice of the excuse which the most judicious and learned bishop of Sarum has thought fit to make, for changing the manner of

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[25] Ibid., 7.

[26] William Wall, *The History of Infant-Baptism. Being An Impartial Collection of all such Passages in the Writers of the Four first Centuries as do make For, or Against it. Part 1*, 2nd ed. (London: Printed by Joseph Downing for Richard Burrough, 1707).

> baptizing by *dipping* into that of *sprinkling*. His lordship . . . says, 'The danger of *dipping* in cold climates may be a very good reason for changing the form of baptism to *sprinkling*.' This excuse is now become very common, and however insufficient it may seem in itself, has gathered considerable force by being used by men of his lordship's good sense and learning.[27]

Even if Gale's assertion that this excuse had "become very common" were to elicit no response from Wall, it provides, on its own, an intriguing window into the climatic concerns of the populace. At a time in which relatively few scholars were actively addressing, in print, theories about climatic change, common folk, concerned for the temporal safety of their children, may have been at the helm of the discussion.

Gale's statement, however, did elicit a response from Wall, and this response, too, offers a window into one of the dominant perspectives of the natural world in the eighteenth century. In his *Defence of the History of Infant Baptism*, Wall demonstrated the belief that the climate had not undergone any significant change, at least during the Christian era comprising those centuries following its legalization in the 313 Edict of Milan. Wall admitted that "many of the Clergy seem to be of the Opinion of the late Bishop of Salisbury . . . that the Coldness of our Climate is a good Reason to change *dipping* into . . . *pouring*," but he responded by proposing a "few Things to their Consideration":

> That our Climate is no colder than it was for those Thirteen or Fourteen Hundred Years from the beginning of Christianity here, to Queen *Elizabeth*'s Time; and not near so cold as *Muscovy*, and some other Countries where they do still dip their Children in Baptism, and find no Inconvenience in it. That the apparent

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[27] John Gale, *Reflections on Mr. Wall's History of Infant-Baptism. In Several Letters to a Friend* (1711), in *The History of Infant-Baptism. Together with Mr. Gale's Reflections, and Dr. Wall's Defence*, ed. Henry Cotton (Oxford: Oxford University Press, 1862), 2:140.

> Reason that altered the Custom was, not the Coldness of the Climate, but the Imitation of *Calvin*, and the Church of *Geneva*, and some others thereabouts.[28]

Wall's discussion of the climate offers one of the best demonstrations of the point of view that climatic conditions were uniform across much of human history, if not across time altogether. Wall's dismissal, offered without any supporting details, of the apparently common fear of climatic change is itself evidence that there was a growing concern over the changing climate. If there had not been, Wall would have had no need to offer a response.

While discussion of climatic change made its first appearances in the eighteenth-century public sphere, debates about the influence of climate continued unabated. David Hume emerged as one who tended toward the negative in this dispute, but his arguments may also shed some light on nascent theories of climatic change. Hume believed that the characteristics of a nation were dependent on moral rather than physical causes. He found social intercourse to be particularly important for this equation because the "human mind is of a very imitative nature."[29] This "imitative nature," not climate, served as the primary influence for the formation of national character. Hume contended that if "we run over the globe, or revolve the annals of history, we shall discover every where signs of a sympathy or contagion of manners, none of the influence of air or

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[28] William Wall, *A Defence of the History of Infant - Baptism Against the Reflections of Mr*. Gale *and Others. With An Appendix containing the Additions and Alterations in the Third Edition of the History of Infant - Baptism, that are most Material*, (London: Printed for R. Bonwicke, T. Goodwin, J. Walthoe, S. Wotton, S. Manship, R. Wilkin, B. Tooke, R. Smith, and T. Ward, 1720), 144.

[29] David Hume, "Essay XXI: Of National Character," in *Essays and Treatises on Several Subjects in Two Volumes* (1742; London: Printed for A. Millar, 1764), 1:228.

climate."[30] Hume's explication of this position, though consisting of nine major arguments and multiple other contentions, did not address the subject of climatic change. This is in spite of the fact that he did address the changing nature of national character, the prime example of which was the disparity between ancient and modern Greeks. "The manners of a people," Hume wrote, "change very considerably from one age to another."[31]

Although Hume's reference to changing manners as an argument *against* environmental determinism may seem to be an implicit refutation of climatic change, he made in this essay no direct statement on the matter. He instead addressed this question in an essay on the "Populousness of Antient Nations."[32] Hume cited the "observations of L'Abbe du Bos, that Italy is warmer at present than it was in antient times."[33] After citing several examples from ancient texts in defense of this assertion, Hume asked, "Allowing, therefore, this remark to be just, that Europe is become warmer than formerly; how can we account for it?" His answer was "that the land is at present much better cultivated, and that the woods are cleared, which formerly threw a shade upon the earth, and kept the rays of the sun from penetrating to it."[34] Although climatic change did not necessarily have an impact on the populations with which Hume was concerned,

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[30] Ibid., 1:230.
[31] Ibid., 1:232.
[32] David Hume, "Essay XI: Of the Populousness of antient Nations," in *Essays and Treatises on Several Subjects in Two Volumes* (London: Printed for A. Millar, 1764; 1742), 1:411-90.
[33] Ibid., 1:477.
[34] Ibid., 1:479.

he nevertheless encouraged acceptance of du Bos' contentions. In a footnote, Hume explained:

> Tho' the observations of L'Abbé du Bos should be admitted, that Italy is now warmer than in former times, the consequence may not be necessary, that it is more populous or better cultivated. If the other countries of Europe were more savage and woody, the cold winds that blew from them might affect the climate of Italy.[35]

Although theories of climatic change were clearly beginning to circulate among the intellectual classes, arguments that environmental conditions had been uniform across time continued to find outlet in publications. Thomas Crosby, in a 1740 history of English Baptists, discussed Wall's participation in the baptism-climate debate of twenty years before. Introducing a quotation from Wall's 1720 *Defence of the History of Infant - Baptism*, Crosby wrote:

> [T]he Doctor, to shew his zeal for the practice of *immersion* in *baptism*, offers very submissively some few things to the consideration of those of his brethren, who thought the coldness of the our *climate* a good reason to change the antient practice of *dipping* into that of *sprinkling*.[36]

Crosby interpreted Wall's account as evidence that that the temperature of the climate—possibly even a shift toward cooler conditions—had been a matter of concern among Wall's contemporaries. Crosby did not pass judgment on Wall's climatic assertions, but his quotation from Wall demonstrates that climatic change was considered to be a subject of interest in the mid-eighteenth century.

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[35] Ibid., 1:485.

[36] Thomas Crosby, *The History of the English Baptists, from the Reformation to the Beginning of the Reign of King George I* (London: Printed for the author, 1740), 3:xliii.

Desire for the compilation of climatic data, best expressed by authors like Hooke and Plot, did not long remain unattended. The eighteenth century saw an increased awareness in the necessity of finding and compiling records on climate, continuing with great success the process begun in the seventeenth century. Thomas Short's *General Chronological History of the Air, Weather, Season. Meteors, &*c. *in Sundry Places and Times* offers one of the strongest representations of the process. Short's study covers much of what he conceived as human history, from Genesis to the Present, but a majority of its text is dedicated to the few centuries prior to its completion in 1749. Short recognized that "what several and different Effects the same Kind or Constitution of the Weather and Season may produce" had "not yet been so well attended to and examin'd as the Extent and Usefulness of the Subject demands."[37] He believed, however, that this could not "possibly be done whilst these Scraps of Histories lay scattered in a vast Multitude of Authors of different Designs and Professions," including "Historians civil, ecclesiastical, and political; Physicians, Divines, Naturalists, Monks, Fryars, Journalists, Travellers, &*c*." Short bemoaned the fact that while such passages "lay dispersed so wide in an endless Number of Books, and frequently in small fragments," Man "must remain entire Strangers to the only true, valuable, and proper Use of them, so highly and inestimably beneficial to Mankind."[38] This condition was a travesty for both scholars and common folk, for one "extensive Use" of them was for

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[37] [Thomas Short], *A General Chronological History of the Air, Weather, Season, Meteors, &c. in Sundry Places and different Times; more particularly for the Space of 250 Years. Together with some of their most Remarkable Effects on Animal (especially Human) Bodies, and Vegetables* (London: Printed for T. Longman and A. Millar, 1749), 1:v.

[38] Ibid., 1:vi.

purposes of comparison, that, "by comparing what has happened for so many Ages past, we may make some tolerable Guess what we may probably expect the next Season or Constitution to be."[39]

The manner by which Short sought to satisfy this scholarly lacuna requires little explanation: he attempted to compile, in two volumes, all of the known natural events of human history. He chronologically arranged the entries in paragraph-form and identified them with dates in the margins. Following a brief preface and prælogmena, which discussed historical investigation of climate and the relationship between climate and disease, Short commenced upon a two-volume chronology which would, by its completion, comprise well over 500 pages. He granted to some years no entry, some a single line, and, still others, several pages. Longer entries include specific details for months, and sometimes days, but many entries, particularly those prior to the seventeenth century, included only general discussions of the years and seasons. Earthquakes, storms, droughts, famines, and epidemics were all important elements of his chronology, as were astronomical phenomena like meteors, comets, and the surprisingly frequent appearance of dragons. There is no entry perfectly representative of Short's chronology, but a passable one is offered to allow insight into Short's organization and style. The entry for the year 1260, selected both for its brevity and for its adequate representation of the material covered by the entries, reads:

> The Drought this Summer was so long, great and severe, that Oats and Barley sown in due Time, came not up till near Harvest; then moderate Raines fell, they

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[39] Ibid., 1:vii.

> sprung up, grew and shot, but it being now *Michaelmas*, and no Sun to ripen them, they were mown down, and dried for fodder for the Cattle.-----There was a shocking Inundation on the *Rhine*, fatal to much People and Cattle. [40]

Although this is a rather brief entry, it demonstrates both the subject matter with which Short was concerned and the sometimes jarring way in which he presented it, alternating, as he often did, between vagueness and specificity.

Short remained pessimistic of the potential for the completion of a truly global study because he felt that the differing levels of development amongst societies were too great a hurdle. "A particular continued History of this Kind over the Globe, for a long Series of Years, is not to be expected, however much it may be wanted and desired," he wrote, because a "great Part of the inhabited World is yet unknown to us" and because the "greatest Part of the *American*, *African*, and *Asiatic* Nations, are ignorant and illiterate."[41] Short was, of course, incorrect, particularly in reference to Asia, where excellent climatic records had long been kept. But his pessimism was not limited to non-European societies alone. When histories of natural events had been completed, he found them often "so stuft with Theory, that they seem only intended to support a favorite Hypothesis."[42] In general, though, Short believed that too few people had been "apprized" of the "great Worth and Use" of "such Histories . . . to all People who breathe in the Air, are fed by the Products of the Earth, and have Bodies to be influenced

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[40] Ibid., 1:151.
[41] Ibid., 1:vii.
[42] Ibid., ix.

by the Vicissitudes and Alterations, or Extremes, good or bad, of Weather and Seasons."[43]

It is this concern for which Short may deserve the greatest commendation. His actual chronology of natural events—and the nature of the sources on which it is based—has been called in to question by modern analysts.[44] But to focus only on this rather narrow utility of Short's contribution—as a perfectly accurate source—is to do the man a great disservice. Short's *General Chronological History* represents one of the first attempts in English to trace year-by-year, and sometimes month-by-month, the movements of the natural world and their consequences for human life. Having dedicated sixteen years to "collecting and compiling" this history, and "making Deductions from it," it should come as no surprise that Short was concerned about its reception.[45] He had little doubt about its uniqueness, though, stating that "[w]hatever Reception this attempt may meet with from the World, the Author is conscious it was well intended, was much wanted, [and] is the first of its Kind; and would be heartily sorry to find his many Years indefatigable Toil in compiling it, to be *useless*."[46] Although many adjectives could be applied to Short's contribution to history—almost all of them positive, *useless* is certainly not among them. Thomas Short helped illuminate

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[43] Ibid., viii.
[44] Hubert H. Lamb, *Climate, History and the Modern World*, 2nd ed. (London: Routledge, 1997), 83.
[45] Short, *General Chronological History*, xv.
[46] Ibid., xiv.

and disseminate a relatively new concept, the authentic relationship between history and climate, and he did so in a format that has remained in use to the present.[47]

As the study of history itself became a subject of increasing attention and discussion during the eighteenth century, consideration of climate's place in history maintained a position of some importance. As part of his 1738 *Letters on the Study and Use of History*, Henry St. John, Lord Viscount Bolingbroke, issued a strong condemnation of environmental determinism. Republished in 1752, Lord Bolingbroke's *Letters* became the subject of extensive debate throughout the 1750s. Bolingbroke suggested if one were to "go to the utmost extremities of the East or the West," visiting the "barbarous nations of Africa" or the "inhospitable regions of the North," one would "find no climate so bad, no country so savage, as not to have some people who come from abroad, and inhabit there by choice."[48] This was no insignificant comment, for it went against the grain of the vulgar determinism often ascribed to early theorists. One of the authors of the magisterial eighteenth-century series, *An Universal History from the Earliest Account of Time*, echoed this sentiment in a discussion of the fertility of China.

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[47] Recognition of the unique value of Thomas Short's contribution is not a recent phenomenon. An 1871 dictionary for practitioners of insurance made specific note of Short's chronology as part of an entry on "climate." The editors suggested that Short "may be regarded as one of the first English writers who entered upon a series of obs. [observations] in regard to the climate, and its influence upon human health and longevity." See Cornelius Walford, *The Insurance Cyclopædia . . . And a Compendium of Vital Statistics* (London: Charles and Edwin Layton, 1871), 1:593. In an 1882 article on smallpox in the Statistical Society of London's journal, author William A. Guy referred to the work in an offhand manner, suggesting that it may still have been a book with which his readers were familiar. Searching through past investigations for evidence of a relationship between the medical term "flox" and the more recognizable term "small pox," Guy noted the helpful comments that he had found "in that remarkable compilation, 'A general chronological history of the air, weather, season, meteors, &c,' published in 1749." See William A. Guy, "Two Hundred and Fifty Years of Small Pox in London," *Journal of the Statistical Society* 45, pt. 3 (September 1882): 401. Short's contribution to natural history, clearly, had not been found *useless*.

[48] St. John, Henry, Lord Viscount Bolingbroke, *Letters on the Study and Use of History* (1738; repr., London: Printed for A. Millar, 1752), 238.

In an eclectic discussion of Chinese civilization and postdiluvian settlement patterns, the author suggested that "the extraordinary fertility of the country" was "more owing to the ingenuity and indefatigable industry of the inhabitants, than to the mere natural fecundity of its soil or climate."[49] Neither of these examples were complete rejections of climatic influence; instead they emphasize the importance of human agency in the experience of life.

Historian Adam Ferguson added his voice to the discussion of climate in a 1767 essay on civil society. One part of Ferguson's essay, titled "Of the History of Policy and Arts," opens with a section on "the Influences of Climate and Situation."[50] It is important to note that lengthy discussion of climate is not found in Part I, "Of the General Characteristics of Human Nature," or in Part II, "Of the History of Rude Nations," where one might expect to find a stereotypical discussion of climate as an explanation for the comparative characteristics of people within and without Christendom. Although Ferguson maintained much of the trope of the munificent temperate climate, the fact that he classified it as a concern for the practice of policy and accomplishment of arts, including those of a commercial nature, demonstrates that he understood climate to have acted within the larger sphere of human society.

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[49] *The Modern Part of An Universal History, from the Earliest Account of Time*, Vol. 8 (London: Printed for S. Richardson, T. Osborne, C. Hitch, A. Millar, John Rivington, S. Crowder, P. Davey, and B. Law, T. Longman, C. Ware, 1759), 332. For information on this incredible series, see *Proposals for Publishing the Modern Part of the Universal History. Compiled from Original Writers, by the Authors of the Antient. Which will perfect the Work, and render it A Complete Body of History from the Earliest Account of Time, to the Present*, London: Printed for T. Osborne, 1758.

[50] Adam Ferguson, *An Essay on the History of Civil Society* (Edinburgh: Printed for A. Millar and T. Caddel, 1767), 165.

Ferguson understood civilization to be a dynamic, rather than static, state of being. He believed that the "most remarkable races of men" had "been rude before they were polished," and "have in some cases returned to rudeness again."[51] Climate, character, and geography shared a complex relationship in Ferguson's formulation; he held that "variations of temperament and character . . . do not indeed correspond with the number of degrees that are measured from the equator to the pole, nor does the temperature of the air itself depend on the latitude."[52] The composition of the soil and the proximity of the sea were equally important factors. Ferguson thus recognized that situation and climate could affect society on a multiplicity of levels and through a multiplicity of means, but the only relationship he explored at length was the narrow, traditional physical relationship posited between body and Nature.

Ferguson's conclusions about climate and human life were tempered by recognition of the impact of social forces—although he never stated this quite so plainly. Ferguson acknowledged that "we are still unable to explain the manner in which climate may affect the temperament, or foster the genius of its inhabitant." He firmly believed that there was an impact, but he recognized that the state of knowledge about the human body and mind was then too incomplete to adequately support any conclusion. In a candid passage, Ferguson wrote:

> That the temper of the heart, and the intellectual operations of the mind, are, in some measure, dependent on the state of the animal organs, is well known from experience. Men differ from themselves in sickness and in health, under a

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[51] Ibid., 166.
[52] Ibid., 177.

> change of diet, of air and of exercise: but we are, even in these familiar instances, at a loss how to connect the cause with its supposed effect: and though climate, by including a variety of such causes, may, by some regular influence, affect the characters of men, we can never hope to explain the manner of those influences till we have understood what probably we shall never understand, the structure of those finer organs with which the operations of the soul are connected.[53]

Ferguson suggested only that, on a moral basis, all extremities of temperature would be "equally unfavourable to the active genius of mankind." In support of this suggestion, Ferguson cited Rousseau's conclusion that the arts had flourished in the "least favourable situations."[54] Unfavorable, in this formulation, of course actually referred to the temperate zones, not to the arctic, which never fit this model. An "unfavourable" situation, then, was favorable for civilization because it stimulated the creativity of man—far more, in fact, than any innate capabilities. "It is vain to expect," Ferguson asserted, "that the residence of arts and commerce should be determined by the possession of natural advantages," as "Men do more when they have certain difficulties to surmount."[55]

The significance of Ferguson's contribution is three-fold. Ferguson recognized that climate could not be accurately measured in the ancient sense, which was based solely on latitude and the lengths of longest days. One instead had to account for a given area's geographical characteristics, which had as great an impact on its environment as did its classically-defined climate. Ferguson also contributed to the discussion by explaining the enormous difficulty accompanying any attempt to define the relationship

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[53] Ibid., 180.
[54] Ibid., 181.
[55] Ibid., 182.

between humans and the environment. A third contribution of Ferguson's work was its attempt to ascertain the forces by which *Man* might affect the climate. Ferguson understood climate to be partially determined by the relationship between forests, lakes, and the atmosphere. He wrote that the "great lakes" and "crouded forests" of the "uncultivated" American countryside were "supposed to replenish the air with heavy and noxious vapours, that give a double asperity to the winter, and, during many months . . . carry the inconveniences of the frigid zone far into the temperate."[56] Although, on the surface, such theories may seem easy to dismiss, Ferguson may have been on the right track. Recent research completed by climatologist William Ruddiman has suggested that the extreme depopulation of the Americas after European contact resulted in an increase of natural flora, a decrease in atmospheric carbon, and a concomitant decrease in temperature—a conclusion not terribly different from Ferguson's tentative attempt to understand the influence of Man on climate.[57] Although Ferguson's identification with anthropogenic, rather than natural, climatic change may have been merely a representation of the Enlightenment principle of "civilizing nature," his contribution to climate theory was no less significant. Over the course of the next century, theories about the role of the forest in controlling regional climates would become a common theme of environmental writing.

Despite the fact that some writers, like Adam Ferguson, were attempting—by design or accident—to develop more nuanced understandings of climate, some theorists

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[56] Ibid., 177-78.

[57] William F. Ruddiman, *Plows, Plagues, and Petroleum: How Humans Took Control of Climate* (Princeton: Princeton University Press, 2005), 117.

continued to recall the hard definitions provided by the ancient world. Historian George Costard noted in 1767 that the "word *Climate*, or *Clime*, in common language, and so likewise among the poets, bears no very precise and determinate meaning, being frequently used for country in general." Its ancient usage, however, meant "a tract on the surface of the Earth, included between two parallels of latitude, where the length of the longest day in one, exceeds the longest day in the other, by half an hour."[58] This is, in fact, almost word-for-word the definition Costard offered for climate later in his history of astronomy. Although some, like Costard, maintained the traditional usage, the very definition of the word "climate" was undergoing a transformation from one characterized by rigidity to one remarkable for its relativity.

Discussion of climate is not, at present, limited to nonfiction publication, and the same was true in the eighteenth century. Frances Brooke's 1769 novel, *The History of Emily Montague*, is remarkable for both its discussion of the role of climate in societal development and for its discussion of unusual climatic circumstances during a few years of the period that would come to be called the Little Ice Age. Protagonist Emily Montague notes in one passage that her home, Quebec, has "had five days, the severity of which none of the natives remember to have ever been equaled" in which, "'tis said, the cold is beyond all the thermometers here, tho' intended for the climate."[59] Brooke's novel serves as a platform for the presentation of ideas about the role of climate in the

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[58] George Costard, *The History of Astronomy, With its Application to Geography, History, and Chronology; Occasionally Exemplified by the Globes* (London: Printed by James Lister, 1767), 4.

[59] Frances Brooke, *The History of Emily Montague* (London: Printed for J. Dodsley, 1769), 1:215-16.

formation of social and cultural traditions. Brooke's interpretation of this role is marked by neither determinism nor rejection, but instead by an uncertain balance between the two. In a philosophical passage as reflective of the era's ideas about climate as of the author's fictional Quebec, Emily states:

> I no longer wonder the elegant arts are unknown here; the rigour of the climate suspends the very powers of the understanding; what then must become of those of the imagination? Those who expect to see "A new Athens rising near the pole," will find themselves extremely disappointed. Genius will never mount high, where the faculties of the mind are benumbed half the year.[60]

Despite the depredation of such a harsh climate, Brooke's novel did not completely dismiss the role of human agency. Describing the types of fruits available for consumption in Quebec, Emily writes that "[n]ot a peach, nor any thing of the kind" was available, but she explains that this "is less the fault of the climate than of the people, who are too indolent to take pains for any thing more than is absolutely necessary to their existence."[61] In another letter, Emily explains that Quebec "is like a third or fourth rate country town in England; much hospitality, little society; cards, scandal, dancing, and good chear." These were "all excellent things to pass away a winter evening," and, significantly, were "peculiarly adapted to . . . the severity of this climate."[62] Emily describes other customs—such as holiday parties—as being "calculated . . . for the climate."[63] The examples Brooke included in this novel—though found in an unexpected location—offer one of the best early examples of the debate

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[60] Ibid., 1:216-17.
[61] Ibid., 1:129-30.
[62] Ibid., 1:205.
[63] Ibid., 1:217.

waged in each mind of the influence of climate on everyday life and history, a debate that would continue into the twentieth century. Climate was clearly beginning to be understood as a critical actor in human affairs, but an actor whose import could not be separated from the idiosyncrasies of culture.

Although most historians and philosophers were focused on the influence of climate rather than its potential for change, some, like historian Robert Henry, were beginning to explore this important problem. Writing in 1771 on the history of Great Britain, Henry suggested that, because the "climate of a country hath so great an influence on its inhabitants," it is "proper to pay some attention to the accounts which are given us by the most ancient writers, of the climate of this island in their times."[64] Study of past descriptions of climate was "necessary," he believed, because "the comparative degrees of heat and cold," in both Britain and Gaul, "were very different in those times from what they are at present."[65] Citing the accounts of classical writers like Diodorus Siculus, Julius Caesar, and Tacitus, Henry noted that, at the height of Roman rule, a climate "moderately warm in summer" and "not excessively cold in winter" was "not unfavourable to the growth and strength of the bodies of men and other animals."[66] Also citing Montesquieu to support his argument, Henry concluded that "a considerable change must have happened in the climate."[67] Although Henry emphasized the traditional import of climate as "an influence on the constitutions, tempers, and manners

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[64] Robert Henry, *The History of Great Britain, From the First Invasion of It by the Romans under Julius Caesar* (London: Printed for the author, 1771), 1:281.
[65] Ibid., 431.
[66] Ibid., 432.
[67] Ibid., 431

of its inhabitants," his investigation was among the first to offer unrestricted recognition of climatic change over time.[68] It is thus representative of the sea-change in the understanding of climate that had occurred over the course of the second half of the eighteenth century. Henry made one further contribution to the nascent discipline of climatic history by demonstrating a unique awareness of the interdisciplinary difficulties that accompany study of climatic change. "It belongs rather to the naturalist than the historian," he wrote, "to account for this change in the comparative state of the atmosphere of these two countries." Historians, however, might observe "that the mildness of the air of Britain was no small happiness to its inhabitants in these times, when they were so imperfectly clothed; and contributed not a little to its being so well peopled."[69]

Henry was not alone in exploring the historical dynamic of climate and climatic change. Edward Gibbon joined Henry in incorporating climatic difference into his historical narrative. In the first volume of his renowned *History of the Decline and Fall of the Roman Empire*, Gibbon addressed climatic change as part of an attempt to better understand the conditions of ancient Gaul. He found favor in the idea of a changed European climate because of the difficulty inherent in reconciling ancient and modern descriptions of Germany. Gibbon praised the proprietors of a changed climate and referenced, in particular, the contributions of Hume, the Abbé du Bos, and Simon

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[68] Ibid., 430.
[69] Ibid., 432.

Pelloutier.[70] These "ingenious writers," he wrote, had "suspected that Europe was much colder formerly than it is at present; and the most ancient descriptions of the climate of Germany tend exceedingly to confirm their theory."[71] Frozen rivers and the geographical distribution of reindeer were evidence of this. Gibbon did not believe, however, that evidence of a changed climate was necessarily evidence of a significant climatic influence. He warned that it was "difficult to ascertain, and easy to exaggerate, the influence of the climate of ancient Germany over the minds and bodies of the natives."[72] Although Gibbon granted relatively little discussion to climatic change, his contribution to its integration in history was nevertheless great because his history incorporated and disseminated the important theories of several authors, some not well-known.

The transformation of the definition of "climate," it has been shown, was accompanied by a transformation in the understanding of its place in history. The new relativity of the word was evident in the assertions of Lord Bolingbroke and in the *Universal History*, as well as in the fictional work of Frances Brooke. Although some form of environmental determinism remained an appealing concept to historians and

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[70] Simon Pelloutier was one of the few to address climatic change in historical time, doing so at the remarkably early date of 1740. At the beginning of the twelfth chapter of his history of the Celts, Pelloutier noted in the margin that "Le Climat des Gaules, de la Germanie, & de la Thracie, doit avoir été autrefois beaucoup plus froid, qu'il ne l'est aujourd'hui." Pelloutier had an important influence on the history of climate through Gibbon's work, but there was a long delay between the two publications. Pelloutier's analysis is rather exceptional and, although it is not addressed at length here, his contribution is recognized; see Simon Pelloutier, *Histoire des Celtes, et particulierement des Gaulois et des Germains, depuis les tems fabuleux, jusqu'à la prise de Rome par les Gaulois* (La Haye: Isaac Beauregard, 1740), 120.

[71] Edward Gibbon, *The History of the Decline and Fall of the Roman Empire* (London: Printed for W. Strahan and T. Cadell, 1776), 1:218.

[72] Ibid., 1:219.

writers at the end of the eighteenth century, it was becoming more easily defined by its exceptions than by its absolute rule. This is not to say that most authors dismissed the environment—absolutely not! But it does become increasingly apparent that the agency granted to the environment was contingent upon its interaction with society; it was not merely a distant puppeteer or *deus ex machina*.

The Abbé Raynal's history of North America, also written in the 1770s, is illustrative of these themes. Raynal's composition contains several dozen references to the natural climate in the fourth volume alone, and it offers a valuable perspective of environmental determinism as applied to specific rather than merely theoretical circumstances. Raynal's understanding of the relationship between humans and nature was not purely deterministic and allowed for human agency, but it granted a central role in history to the environment and, more specifically, to the resources it contained. Writing of North America, Raynal noted that the "diversity of governments is not the work of the mother country," for there are no "traces of a reasonable, uniform and regular legislation." Raynal instead traced the development of these governments, and their "motley variety of constitutions," to "chance, climate, [and] the prejudices of the times and of the founders of the colonies." Considering the ideal that legislation should represent the best interests of society, Raynal deduced that all legislation should thus spring forth from the natural circumstances of the polity. "Climate, that is to say, the sky and soil," Raynal wrote, "are the first rule for the legislator," whose "resources dictate to

him his duties."[73] Raynal's perspective was not based upon observation alone, though, as it made reference to Polybius' second century, B.C., conclusions on the climate. Discussing the state's duty to ensure the success of manufacturing, Raynal asserted that this duty "depends on the climate, which, as Polybius says, forms the figure, complexion and manners of nations."[74]

James Dunbar reiterated much of this idea of a "limited determinism" in his essays, published in 1780. Dunbar had no doubt that the climate had been and continued to be an influence on the progression of history, and he thought this to be a commonly shared belief. "The influence of climate on the policy, if not on the character of nations," Dunbar wrote, "is acknowledged by every observer of human affairs." Acknowledging that it was difficult "to estimate this influence," Dunbar attempted to "set bounds to its empire" in the sixth essay of his collection.[75] He concluded that there were two ways of looking at climate. The first of these recognized it as "a natural principal, acting with powerful energy, or with irresistible impulse, on the fabric of our being."[76] The second perspective posited climate as "a local circumstance leading to a variety of action in the œconomy of civil life." This "limited determinism" allowed

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[73] [Abbé Guillaume Thomas François Raynal], *A Philosophical and Political History of the Settlement and Trade of the Europeans on the Continent of North America*, trans. J. Justamond (Dublin: Printed for William Halhead and John Exshaw, 1776), 4:360.

[74] Ibid., 494.

[75] James Dunbar, "Of the General Influence of Climate upon National Objects," in *Essays on the History of Mankind in Rude and Cultivated Ages* (London: Printed for W. Strahan, T. Cadell, and J. Balfour, 1780), 207.

[76] Ibid., 207-08.

room for human agency. Dunbar believed that climate, if viewed from this perspective, "will appear eminently to affect the progress of arts and government."[77]

Dunbar's essay also demonstrated the idea that there existed an inverse relationship between natural circumstances and civilization, an important theme of climate theory well-into the twentieth century. Dunbar believed that climate and the unequal distribution of verdant land were determining factors for both war and the stratification of society. Nature held "no inconsiderable sway over the general fortune of the world," but this "sway" was inverse rather than direct. Dunbar suggested that the "circumstances apparently the most favourable prove often, in their consequences, the most adverse to the great proceedings of nations." Nature, he believed, could be compared to "an overindulgent parent."[78] It could also be underindulgent, though, as too severe of a situation could be equally detrimental. Ideal circumstances were located along a spectrum, presupposing what some today might feel inclined to call a "Goldilocks" theory. "A middle situation between those extremes," Dunbar asserted, "is perhaps the most eligible in a moral light, as well as the most auspicious for civil progress."[79] Dunbar was no advocate of a direct or uncomplicated relationship. In explaining the characteristics—particularly those of a psychological or philosophical nature—of "any latitude or climate," there was "no need to recur to the positive and direct influence of the outward elements on the human mind." The progression of events might be "governed more perhaps be moral than by physical causes," echoing, to some

[77] Ibid., 208.
[78] Ibid., 221.
[79] Ibid., 222.

degree, the conclusions of David Hume's twenty-first essay and Richard Bentley's "The Folly of Atheism," which refused to ascribe to Nature sins that Man was perfectly capable of committing on his own.[80]

By the second half of the eighteenth century, natural philosophers and historians—along with clergymen and novelists, had begun to develop new understandings of their native climates. From the early works of scholars from the Royal Society, like Robert Hooke, Christopher Wren, and Thomas Sprat, through the important contributions of William Aglionby, Thomas Short, and even Frances Brooke, several important trends are evident. Scholars began to understand the environment as a real entity rather than as a theoretical construct. Atmospheric halos, meteors, and terrible storms were no longer merely omens, they were now a feature that could be tabulated, counted, and compared. Dragons, though undoubtedly still capable of eliciting terrible fear during their occupation of the sky, were now also relegated to a section of a chronological history—a section would could be compared to those of hundreds of other years which saw no dragons. Climate began to be understood as an important element in religious debates, as well as in discussions of geopolitics and commerce. People began to see the environment as a part of their lives—a part which could be exploited, hated, left, or overcome, but a part just the same.

The idea that the environment—and, in particular, the climate—was variable rather than static also took hold during the years prior to 1780. Concerned parents grew

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[80] Ibid., 225.

increasingly wary of submerging their children in baptism and made enough noise of their concerns to warrant inclusion in several publications throughout the century. Historians incorporated climate into their narratives. Fictional letters in novels discussed the fact that climatic conditions were different than any in memory. Not all, of course, suggested that the climate had changed, nor did all ascribe to it a deterministic role, but their willingness to consider climate within the broad frameworks developed during the eighteenth century, and their attempts to draw comparisons across space and time, were an important stage *en route* to present interpretations. That there was no inevitable march to a perfect interpretation does not lessen the significance of these authors; even present interpretations are subject to revision, retraction, and renewal. This is the nature of science. The arguments about the influence and variability of climate addressed by this chapter are mere snapshots of philosophy in flux, but the natural scholars engaging them were instrumental in setting the stage for future analyses.

CHAPTER III

THE FIRST GREAT AGE OF CLIMATIC PERIODIZATION

As the eighteenth century drew to a close, ideas about climatic variability and influence found more frequent expression in learned circles, as well as in the works of the era's great natural historians and philosophers. These scholars also made the first efforts toward the identification of "unusually" cool or warm climates. It is suggested here that the forty years between about 1780 and 1820 represented the "first great age of climatic periodization." This is not to say that others had not attempted this before 1780. Classical authors of Greece and Rome had certainly made suggestions about differences between climates of the past and that of the present, and the preceding chapter offered several examples in which individuals were certainly cognizant of some alteration in their environs. These earlier ruminations on climate, however, were not focused upon the identification of climatic periods, nor did they have the benefit of a century of regular records in the format Robert Hooke suggested. The beginning of the nineteenth century brought with it the idea that climates of the past were not merely *different*; they were instead different in particular, regular ways. Comparisons between ancient and modern sources, though a continuing theme in environmental writing, were supplemented by additional comparisons with the Middle Ages, allowing the construction of smaller and more historically relevant climatic regimes. By about 1820, the end of this first great age of periodization, natural scholars had developed

remarkably modern chronologies that were not unlike those which would revolutionize the study of history in the twentieth century.

The decades between 1780 and 1820 were remarkable for the number of scholars who engaged the question of historical climatic change. Virginian philosopher Thomas Jefferson is an excellent example. Although he is remembered more for his work on the Declaration of Independence and his tenure as President of the United States, Jefferson also found time to study the climate. He dedicated one section of his 1781-82 *Notes on the State of Virginia* to Virginia's climate. Jefferson largely limited his investigation to records from Williamsburg between 1772 and 1777 and to recollections of eighteenth-century Virginian climate. That the climate had changed, however, he had no doubt:

> A change in our climate however is taking place very sensibly. Both heats and colds are become much more moderate within the memory even of the middle-aged. Snows are less frequent and less deep. They do not often lie, below the mountains, more than one, two, or three days, and very rarely a week. They are remembered to have been formerly frequent, deep, and of long continuance. The elderly inform me the earth used to be covered with snow about three months in every year. The rivers which then seldom failed to freeze over in the course of the winter, scarcely ever do so now.[1]

This alteration in the climate, though in the direction of warming, was not as beneficial for agriculture as one might anticipate. Jefferson suggested that the less-severe winters had resulted in greater springtime temperature fluctuation, thus endangering buds that had once remained dormant much longer.

While Jefferson wrestled with the reality of climatic change, William Smellie sought to better understand the effects of climate on society. His conclusions were

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[1] Thomas Jefferson, *Notes on the State of Virginia* ([Paris]: n.p., 1782), 148.

informed by the same uncertain balance between social and environmental determinism found in many late eighteenth-century accounts. While he utilized a common trope of climate theory, that of a comparison between industrious folk navigating difficult circumstances and "luxurious" folk from more generous climes, his conclusions were far more nuanced than this comparison might suggest.[2] Smellie recognized that "custom, laws, and religious rites . . . produce considerable difference in the articles of food" among those nations which have "no dependence on climate, or the natural productions of the earth."[3] Smellie maintained a Romantic understanding of nature and society, interpreting the structures that offered independence from nature as fetters. Nevertheless, his identification of these structures as fetters serves also as an endorsement of the potential for human agency to overcome nature's obstacles.

Joseph Priestly's *Lectures on History and General Policy*, published in 1791, struggled with the idea of determinism in much the same way, although his struggle is much more apparent because of his book's strong, sometimes contradictory, conclusions. Priestly asserted that historians "will soon observe that, a genius for science by no means depends upon climate."[4] Like Smellie, though, Priestly's contribution was not so much to the study of climatic periods as to the study of climatic theories. Priestly, like Hume, offered Greece as evidence that environmental determinism was intellectually bankrupt. "[W]itness," he argued in reference to scientific genius, "the difference between the

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[2] William Smellie, *Philosophy of Natural History* (Edinburgh: Printed for the Heirs of Charles Elliot and C. Elliot and T. Kay, T. Cadell, and G. G. J. and J. Robinsons, 1790), 216.

[3] Ibid., 217.

[4] Joseph Priestly, *Lectures on History and General Policy: To Which is Prefixed, An Essay on a Course of Liberal Education for Civil and Active Life* (Dublin: Printed for P. Byrne, 1788), 322.

ancient and present state of Greece."[5] The circumstance most "favourable to the rise and progress of learning and the arts" was that of "a number of neighboring independent states" connected through "commerce and policy."[6]

Despite this apparent rejection of deterministic influences, Priestly nevertheless resorted to them to explain the treatment of women as a function of climate. Apparently disregarding the impact of commerce on the place of women in society, he suggested that the "laws which regulate and direct" their treatment "depend very much upon the climate of a country, so that some nations are deprived by nature of the very means of politeness."[7] Priestly also deferred to simplistic characterizations of warm countries as an explanation for the nature of society, but he traced these characteristics to the soil rather than to the temperature—a significant difference for his purposes but a form of environmental determinism nonetheless. Priestly, echoing Adam Ferguson, found it "more reasonable to ascribe the indolence of mankind in hot countries to the general goodness of the soil in those countries, which, without labour, supplies them with the few things which are necessary to their subsistence, than to the heat of the climate."[8] "[W]herever people can live without labour," he concluded, "they are equally idle."[9] Priestly left unexamined the question of whether such natural conditions could change.

William Lemprière, like some of the authors discussed thus far, wrote in favor of a form of cooperative causation: a determinism not limited to nature but shared by

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[5] Ibid., 322.
[6] Ibid., 322-23.
[7] Ibid., 365.
[8] Ibid., 427.
[9] Ibid., 428.

society itself. Writing in 1791, Lemprière credited the influence of climate for the "Moorish" character, but this influence was joined by two social factors. "To think justly and with candour of the Moorish character," he wrote, "we must take into our consideration the natural effects of a total want of education, a most rigidly arbitrary government, and a climate calculated, as far as climate has influence, to stimulate and excite the vicious passions." This stimulating climate also served as a "debilitating and relaxing influence to weaken and depress the nobler energies of the mind."[10] Lemprière's usage of the preposition, "as far as climate has influence," is certainly suggestive of the limitations of environmental determinism, as are his references to the independent influence of social and political structures.

Further antagonism to conceptions of "ideal" and "poor" climates came from the recognition that people might inhabit such climates by choice or, at the very least, seek no alternative. In a 1791 letter on the migration of fish, General Benjamin Lincoln made exactly this contention. Though he suggested that it was only by "the influence of the Governor of the universe" that any people are "found in the burning sands under the torrid" or "on the frozen cragged mountains under the frigid zones," he admitted that, in both, people had happily adapted. "We find . . .under each," he explained, "multitudes . . . who are so fitted for their respective situations, that they are not only happy, but are really partial to the place assigned them." He noted, with what may have been some

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[10] William Lemprière, "Lempriere's Tour from Gibraltar to Tangier, Sallee, Moggodore, &c.," in *The New Annual Register, or General Repository of History, Politics, and Literature, For the Year 1791. To Which is Prefixed, A Continuation of the History of Knowledge, Learning, and Taste, in Great Britain, during the Reign of Queen Elizabeth* (London: Printed for G. G. J. and J. Robinson, 1792), 78.

surprise, that they "envy not the dominion of others, and seldom or never invade them, but from motives of avarice, pride and ambition."[11]

Writing of the British colonies in the West Indies, Bryan Edwards shared in the struggle of drawing a line between social and natural causation. Edwards believed that it was a commonly held position that the climate bore an influence on character. He explained that one must look to the Creoles and Natives of the colonies to search for "the original and peculiar cast of character impressed by the climate." He did not seem overly convinced by this impression, though, as he included the addendum, "if indeed the influence of climate be such as many writers imagine." Edwards understood the climate to have an influence on people's physical characteristics, more so particularly than "on their manners, or on the faculties of their minds."[12] He believed, based on the supposed cool temperature of native skin, that the bodies of Natives had been adapted to suit their climate. He posited that "nature has contrived some peculiar means of protecting them from the heat, which she has denied to the nations of temperate regions, as unnecessary."[13] While this form of evolutionary logic could easily be taken too far, it was not altogether incorrect, as Charles Darwin would soon demonstrate. Edwards made no comparably unqualified statements about the climate's effect on their

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[11] B[enjamin] Lincoln, "On the migration of Fishes. (Vol. III. P. 176) A letter from the Hon. General Lincoln to the Author," in *The History of New-Hampshire. Volume III. Containing a Geographical Description of the State; with Sketches of its Natural History, Productions, Improvements, and Present State of Society and Manners, Laws and Government*, ed. Jeremy Belknap (Boston: Belknap and Young, 1793), 3:460.

[12] Bryan Edwards, *The History, Civil and Commercial, of The British Colonies in the West Indies: In Two Volumes* (Dublin: Luke White, 1793), 2:11.

[13] Ibid., 2:11-12.

"nobleness of disposition," though, wondering if "perhaps Philosophers have relied too much on a supposed sympathy between the body and the mind."[14]

While many writers were wrestling with the problems of climate and character, some were seeking to understand the influence of climate through more objective, measurable avenues. The Reverend John Adams' 1795 *View of Universal History* is indicative of this emerging methodology. Adams suggested that "if there be any such thing as influence of climate, it is surely in India."[15] Although Adams' understanding of this influence remained based upon heat and fertility, he grounded his theory in economic principles. Adams wondered of the disparity between the quantity of rare metals "swallowed up" in India and the fact that "the common people should be so poor as to work almost for nothing." Adams explained this disparity on the grounds that money never circulated amongst the common people because the cost of their labor was inordinately low, regardless of the country's riches. The "extreme fertility of the soil, and the heat of the climate," with the fact that in "all parts of the world a labourer's daily hire seldom exceeds his food and raiment," conspired to hold down the price of subsistence and restrict the circulation of American metal.[16]

Many of the arguments addressed thus far might be interpreted as a sort of "Goldilocks" geography. James Dunbar, through his reading of Rousseau, applied this

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[14] Ibid., 2:15.

[15] John Adams, *A View of Universal History, from the Creation to the Present Time. Including an Account of the Celebrated Revolutions in France, Poland, Sweden, Geneva, &c. &c. Together with An Accurate and Impartial Narrative of the Late Military Operations; and Other Important Events* (London: Printed for G. Kearsley, 1795), 2:31.

[16] Ibid., 2:37.

trope in 1780, and John Dalyell drew similar conclusions eighteen years later in an investigation of Scottish history. In a rather gilded comparison of the situation of Scotland and those of other, undeniably less fortunate, societies, Dalyell exclaimed:

> How various are the effects of climate! And how varied are the pursuits of men! The Turk protracts his inactive life on the carpet of indolence; the Arab wanders in the desert in perpetual change; the Egyptian is nurtured in the luxurious arms of effeminacy; while the Greenlander, in darkness, lives on eternal snow. . . . Happy Scotland! Without the tropical region, nor within the frigid zones;—a climate, temperate, when compared with the piercing blasts of Lapland; temperate, when compared with the tepid zephyrs of Java or of Senegal.[17]

Despite the fact that Dalyell loudly proclaimed the significance of climate, even his discussion of its influence was tempered by social, political, and economic concerns. "Although the manners of mankind are modified by climate," and "although this may be the first cause which excites the difference of ideas," he wrote, "there are some things upon which it has little effect," including the "variety and coincidence of sentiment" and ceremony.[18] Other factors could contribute to the temperament of a society, as well. Although Dalyell believed climate was the "primary" determinant, he recognized that "[d]omestic broils, and little intercourse with other countries" could "retard the improvement of the people." Dalyell's quotation of Strabo exemplified this sentiment: "Destitute of commerce, civilization and society are lost."[19] Joseph Priestly, who had insisted that commerce helped shape society, would probably have found much to favor in this statement.

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[17] John Dalyell, *Fragments of Scotish History* (Edinburgh: Printed for Archibald Constable, 1798), 7.

[18] Ibid., 4.

[19] Ibid., 23.

Equally important in Dalyell's discussion of climate was his recognition of the potential for climatic change. While others had recognized this, few had addressed both climatic influence and climatic change, as Dalyell did. He explained that in the past "Scotland may have been warmer" and referenced the ideas of one philosopher that there had been a "gradual refrigeration of the earth." Evidence for this, Dalyell believed, could be found in "the lives of the Saints" which demonstrated that clothing was more frequently used "between the fifth and the eighth centuries" than had been done in the distant past.[20] While Dalyell did not discuss climatic change at length, his consideration of the philosopher's concept of climatic change, and his investigation of it in light of documentary evidence, provided yet another element for the construction of climate theory.

In 1799 Noah Webster—best-known today for his dictionary—turned his attention to the climate as part of an address to the Connecticut Academy of Arts and Sciences. His "On the Supposed Change in the Temperature of Winter" argued against the grain of contemporary thought. Webster's disputation of theories of climatic change offers further evidence for the popularity of such theories. "It is a popular opinion," Webster began, "that the temperature of the winter season, in northern latitudes, has suffered a material change, and become warmer in modern, than it was in ancient times." So common was this belief that Webster knew "not whether any person, in this age, has

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[20] Ibid., 20.

ever question the fact."[21] Webster then commenced upon a point-by-point refutation of the evidence various writers, including Gibbon and Hume, had posited in suggestions of a colder ancient world. Webster also had no love for Thomas Jefferson, and he took particular pleasure in refuting Jefferson's contention that a sensible climatic change was underway. "Mr. Jefferson," he wrote, "seems to have no authority for his opinions but the observations of elderly and middle aged people."[22] Webster continued:

> It appears to me extremely unphilosophical to suppose any considerable change in the annual heat or cold of a particular country. We have no reason to suppose that the inclination of the earth's axis to the plane of its orbit has ever been varied; but strong evidence to the contrary. If this inclination has always been the same, it follows that the quantity of solar rays, falling annually on a particular country, must have always been the same. Should these data be admitted, we are led to conclude that the general temperature of every climate, from the creation to this day, has been the same, subject only to small annual variations, from the positions of the planets in regard to the earth, or the operations of the element of fire in the globe and its atmosphere.[23]

Webster was also wholly unconvinced that climatic change had influenced vegetation: "I do not find, in history, any evidence that a change of climate generally has carried any of the delicate fruits into latitudes where they did not thrive in the earliest ages."[24] Others would soon disagree.

Webster, of course, was contending for the comparability of ancient and modern climates; he was not comparing changes of a smaller scale and therefore may have

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[21] Noah Webster, "On the Supposed Change in the Temperature of Winter" (paper read before the Connecticut Academy of Arts and Sciences, 1799), in *A Collection of Papers on Political, Literary, and Moral Subjects* (New York: Webster & Clark, 1843), 119.

[22] Ibid., 144. For a most enjoyable account of Webster's and Jefferson's contributions to early American climatology, see Randy Cerveny, "Noah Webster: Lexicographer, Climatologist," *Weatherwise* (July/August 2009), 38-43.

[23] Webster, "Supposed Change," 145.

[24] Ibid., 134.

missed an opportunity to define a cooler, post-medieval period. In a remarkable passage, Webster asserted:

> But Gibbon's assertion that the Rhine and the Danube, in modern ages, have not been covered with ice, strong enough to sustain loaded carriages, must not pass uncontradicted. I know not what ages precisely, that author intended to include in the description of *modern;* but both the rivers mentioned have *often* sustained men and carriages on the ice within the *last two centuries*, as well as in preceding ages. . . . I have no particular account of the effects of the rigorous cold of 1608, 1610, 1664, 1684, 1698, 1709, 1716, 1740, 1763, 1776, on those particular rivers; but the general accounts describe these and many other winters, during the last two centuries, as converting *all* rivers into highways for carriages, even as far south as Italy and Spain.[25]

Webster, so caught up in his attempt to utterly disassemble the assertions of scholars who had reasoned from limited—or incomplete—sources, completely overlooked the possibility that the climate had changed in the preceding 600 years.

The history of climate, and the study of its change, was well-ingrained in society by the opening of the nineteenth century. Climate increasingly became recognized as a topic worthy of study on its own account, and not merely as a chapter of natural history. This valuation of climate, especially when considered in concert with other social forces, is apparent in the earliest investigations of the century. A brief letter between doctors in 1802 demonstrates this perfectly. Writing on an outbreak of yellow fever, the authors opened their argument by stating that "[t]he great influence of the weather and climate over the health of man, especially when combined, in places of crowded population, with the agency of local causes, is universally allowed."[26]

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[25] Ibid., 135.

[26] "A short History of the Yellow Fever which prevailed at Norfolk in the Months of August, September and October, 1801; with some Account of the Diseases that preceded and followed its

The early nineteenth century also saw the first lengthy publications both dedicated to and advertised as studies of climate. John Williams' *The Climate of Great Britain; or Remarks on the Change It Has Undergone, Particularly within the Last Fifty Years*, published in 1806, stands as one of the first books in English dedicated, from its outset, to the subject. Williams concerned himself with the economic consequences of climatic change, noting even in his title that his investigation covers the "Effects such ungenial Seasons have produced upon the Vegetable and Animal Economy."[27] Williams conceived of his investigation as "novel," and suggested that "the path which leads to it" was "as yet untrod." Although this was not entirely the case, as several of the above passages have demonstrated, Williams was correct in noting that, "little progress having hitherto been made in Meteorology, the difficulties to encounter, in such an undertaking, must be consequently great." Regular recording-keeping had not been maintained for very long at this point. Williams had little doubt, however, of the importance of such investigation, describing it in a manner that would not seem out of place even in the present era. The importance of such meteorological study was of "high importance," Williams wrote, "as it not only respects the production of the soil upon which our very

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Appearance. Communicated by Drs. Selden and Whitehead, in a letter to Dr. Miller, dated Norfolk, July 15, 1802," in *The Medical Repository, and Review of American Publications on Medicine, Surgery, and the Auxiliary Branches of Science*, vol. 6, ed. Samuel L. Mitchill and Edward Miller (New York: Printed by T. & J. Swords, 1803), 247.

[27] John Williams, *The Climate of Great Britain; or Remarks on the Change It Has Undergone, Particularly within the Last Fifty Years. Accounting for The Increasing Humidity and Consequent Cloudiness and Coldness of our Sprints and Summers*; *With the Effects such ungenial Seasons have produced upon the Vegetable and Animal Economy*. *Including Various Experiments to Ascertain the Causes of Such Change*. *Interspersed With numerous Physiological Facts and Observations, illustrative of the Process in Vegetation, and the Connection subsisting between the Phenomena of the Weather and the Productions of the Soil* (London: Printed for C. and R. Baldwin, 1806).

existence depends, but refers also to every species of National Improvement," including "the Health of Mankind" and "the comfort of Society."[28]

Williams recognized more than the mere importance of climate; he also recognized the potential for climatic change. More significantly, he was cognizant of the sense, during his time, that the summer climate had been warmer in the past than it was in the present. Williams noted that this had been "an opinion universally adopted of late years." Winters, this opinion held, had become "more mild," but summers had become wetter—and therefore, it was believed, colder—than they "formerly" were. Although Williams recounted this opinion without many specific dates, he found it to be of reputable quality, as it had been remarked upon "not only by speculative, but practical men; by those most observant, because most affected by ungenial weather." The weather's change was recognized even by those incapable of explaining the means by which it could do so. Williams suggested that the "generality of such persons, being addicted to superstition, do not fail on such occasions to cut the knot they cannot untie, and solve every difficulty by having recourse to supernatural means," be it the "malice of our grand enemy, or the judgments of the Almighty."[29] Some late eighteenth-century and early nineteenth-century superstitions of climatic change as punishment, Williams believed, were based upon concerns of the consequences of legislative changes. This

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[28] Ibid., v.
[29] Ibid., 3.

sentiment was captured in the adage: "*for to change the style, with them, is to alter the seasons.*"[30]

It is certain that such superstitions existed. Even in the twenty-first century one needs only to experience or closely watch the landfall of a hurricane to witness the usage and propagation of such ideas.[31] It is nevertheless important to note that this reliance on superstition was not present in many of the works that reached the printing press, and as such are likely to be supported by evidence outside the purview of this narrative. Williams found superstitious explanations to be unsatisfactory, though, and sought to determine which natural forces were capable of determining climate. Williams' understanding of climate emphasized neither unilateral determinism nor insignificance, instead interpreting it as a force which maintained the authority to shape its domain while also being shaped by it. Williams sought to understand, in essence, the human impact on climate. "It will therefore be an useful and necessary inquiry," he contended, "to ascertain what changes of this nature have occurred for a series of years back, and how far they may have been affected by human art."[32] The debate over anthropogenic climate change is not a landmark of the late twentieth century; as a concept, it has been a central concern of climate theorists for more than two centuries.

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[30] Ibid., 4.

[31] A famous contemporary example of climate's supernatural side may be found in the 2005 landfall of Hurricane Katrina. In a story that captured international attention, some found evidence for divine intervention amongst the storm's destruction. A statue of Jesus outside St. Louis Cathedral was found standing between two fallen, 150 year-old trees. The only damages the statue sustained were a broken thumb and a broken index finger—evidence, for some, that Jesus had intervened, flicking the storm over just enough to prevent the city's complete destruction. For an account of this story, see James Varney, "New Orleans' restoration to end with statue's fingers, Hughes says," *The* [New Orleans, La.] *Times-Picayune*, October 7, 2005.

[32] Williams, *Climate of Great Britain*, 5.

Williams found natural explanations for climatic change to be generally insufficient, but his suggestion of a human role should not be interpreted, as it would be two centuries later, as a cause for alarm or condemnation. Civilized Man improved Nature. Before contact with the civilization of Rome, Britons "subsisted principally on flesh and milk," but they were "soon taught to turn their attention to agriculture." Williams believed that this point marked "the commencement of an improvement in the climate."[33] With this reasoning it was found that the more the land was improved upon, the more the climate itself improved. These were the circumstances, he believed, that permitted the famed cultivation of English vineyards. This cultivation, even at present a subject of much consideration, was heavily debated in Williams' era as well. Although ancient records left little doubt of the cultivation of *vinea*, some writers were unsatisfied that *vinea* referred to the grape. Williams noted, with much excitement, that some "suppose it meant not a plantation of grapes for the purpose of making wine, but an apple orchard, or currant garden!!"[34]

Central to determining the veracity of vineyard records, of course, was the fact that the vine was no longer cultivated in England. Williams could offer no timeframe for the abandonment of viticulture, but he had little doubt about the *reason* for its abandonment: climatic change. Cultural factors were important. Williams considered it possible that vineyards were a product of Roman civilization that was slowly forgotten after their formal departure. He also thought it reasonable that the nature of taste and

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[33] Ibid.
[34] Ibid., 11.

trade rendered such cultivation unnecessary when faced with competition from superior French wine. These were, however, "auxiliary causes," at best, because "the most powerful one appears to be that which has been by most overlooked." Emphasizing his theory with italics, Williams asserted the following: *"A succession of unfavourable seasons was probably the promoting, if not the immediate cause of a general dereliction of such a profitable kind of husbandry*."[35] Williams appealed to objectivity, defending his assertion with examples from scientific experiments that showed the failure of "[n]umerous trials . . . to cultivate the vine again, . . . even with the advantage of a convenient wall and southern aspect."[36] Williams was extremely confident in the veracity of his theory of a changing climate, shaped as it was through observation, experimentation, and historical research of the documents of several millennia. Williams concluded the introduction to his study of British climate thus:

> Admitting the authorities I have quoted to be authentic evidence, that the vine was successfully cultivated in former ages, and of the failure of such a culture in the present; it furnishes a strong proof of the increased coldness of our summers, and in a measure supplies the place of a thermometrical register of temperature in those times, enabling us to form a comparison with the present.[37]

Although Williams was particularly concerned with explaining the reasons for climatic change, his comprehensive examination of both warming and cooling and his use of both scientific evidence and historical documentation mark the first true example of what would later be called historical climatology. Williams should also be recognized as one

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[35] Ibid., 13.
[36] Ibid., 14-15.
[37] Ibid., 15.

of the earliest theorists, if not the first, to provide some definition for the period that would one day be called the Little Ice Age.

Williams' *Climate of Great Britain* did not, however, go unnoticed in its own era. While the authors of one review thought it noteworthy that Williams "not only endeavor[ed] to establish the fact" of climatic change, but also sought to explain why cooling had occurred and how it might be reversed, the subtly scathing and openly dismissive review found little of favor in Williams' methodology and conclusions. Much of the review was a critique of William's understanding of the mechanisms of climate, but it also addressed the question of a cooling Britain. Although the authors held that it was "the birthright of an Englishman to murmur at the uncertainty of the weather," they were less inclined to take seriously assertions of a deteriorating climate:

> [W]hen we hear persons assert that the climate is becoming more unsettled and less congenial to the vegetable kingdom, we are generally disposed to impute this opinion either to the querulousness of old age, or to the moroseness of individual temper and disposition.[38]

The authors' dismissive attitude towards Williams' conclusions is apparent in their choice of words and emphasis. The review noted that the "proof of the fact, that the climate of Great Britain has undergone a considerable change *during the last* 50 *years*, rests principally on the testimony of an old monkish historian, who flourished *in the* 12*th* century." Although the review acknowledged that medieval descriptions of the flora of Britain were "very different from the present state of things in the most favoured parts of the island," it asserted that the reliability of such accounts must be measured by

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[38] "Art. III," *The Monthly Review* (September, 1807): 20.

"the accuracy of the narrator." Of this, however, they were "extremely skeptical." The relevance of the medieval writer's age or occupation to the veracity of his claims is not discussed at length, suggesting that the reviewers were engaged in that all-too-common characteristic of modern debates—the *argumentum ad hominem*. This assertion is further supported by the reviewers' explanation for their skepticism: The general character of the writers of the period . . . is such as to justify the utmost degree of caution in receiving their testimony; and in the present instance, we apprehend that the account is sufficiently extravagant to refute itself." Although the reviewers did not dismiss the former cultivation of grapes—suggesting instead that their quality was exaggerated—they contended that the abandonment of viticulture was more the result of the "increased intercourse" between England and France.[39] After criticizing this aspect of William's investigation—along with its other constituent parts—the authors announced that, "under the impression which it must necessarily produce on the minds of all our readers, we shall take our leave of the author and his hypothesis."[40]

Williams' volume was reviewed again, with much the same reception, in an 1807 edition of *The New Annual Register*. As in the *Monthly Review*, the reliability of medieval scholarship was again at the heart of the dispute. Williams' conclusions about climate were posited as an assumption:

> Our author assumes it as a fact, that the climate has changed, and is become much moister and colder than in former eras, chiefly upon a loose assertion of William of Malmesbury, who wrote in the twelfth century, that many parts of

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[39] Ibid., 21.
[40] Ibid., 24.

> Gloucestershire and the Isle of Ely afforded as good vineyards as any of the provinces of France.[41]

This assumption, the reviewer believed, was utterly without merit, as William of Malmesbury's assertion "is so desultory and unsupported by other testimony, that it is scarcely worth attention, much less entitled to become the foundation of so sublime and daring a project" as that of Williams' *The Climate of Great Britain*.[42]

As for Williams, as a person, the reviewers proposed that he and his theoretical committee for controlling climate be relegated to the "vaporous regions" of which he so often spoke.[43] As should be apparent from both of these criticisms, the actual issue of a *changing climate* was rarely the subject of consideration. Methodology was rebuked. Sources were condemned. Character was slandered. But the actual issue at hand was left unexamined. There was no reference to accounts completed in the immediately preceding centuries—only a rejection of those penned six-hundred years prior. Even historians writing in the eighteenth century thought it important to examine meteorological records from all available years; Thomas Short dedicated two volumes to this end! Although Williams' own conclusions would have been strengthened by more research and less haste, the same may equally be said of his critics, whose remarks were

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[41] "Physical and Mathematical. Comprehend'ng Medicine and Surgery, Natural History, Experimental Philosophy, Agriculture, Mechanics, Astronomy, Commerce, Arithmetic, Naval and Military Tactics," in *The New Annual Register, or General Repository of History, Politics, and Literature, For the Year 1806. To which is prefixed, The History of Knowledge, Learning, and Taste, in Great Britain, during the Reign of King William III.—Part III. With a Map of India* (London: Printed for John Stockdale, 1807), 316.

[42] Ibid.

[43] Ibid., 317.

clearly based upon *a priori* conclusions expressed through *ad hominem* criticism. We shall take *our* leave of *them*.

Also writing at this time was Henry Robertson, a physician concerned with the relationships between the atmosphere, agriculture, and disease. This was a subject of some importance for Robertson, as the atmosphere had "been ascertained to be of the most important and indispensable use, in the performance of the functions of the animal and vegetable economy, and to have the effect even of modifying the illuminating power of the sun." Although Robertson's primary concern was to understand how the atmosphere worked, and how it could cause or prevent diseases, he was not silent on the subject of climatic change. He dedicated one section of his natural history to the subject "Of the Supposed Change of Climates in Certain Countries." Robertson's comments suggest that climatic change continued to be a concern of no little discussion in the early nineteenth century. He wrote that the question of "whether the temperature of climates be the same at the present period as they were in the early ages of the world" was a question "frequently agitated." Of central concern was whether such changes were "periodical, and unconnected with local causes."[44]

Robertson did not investigate the subject at length, believing that the limitations of his work did "not permit a tedious historical investigation of the subject."[45] As such he restricted his comments to the general principles of climate as well as to the specific

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[44] Henry Robertson, *A General View of the Natural History of the Atmosphere, and of the Connection with the Sciences of Medicine and Agriculture; Including an Essay on the Causes of Epidemical Diseases* (Edinburgh: Printed by Abernethy & Walker, for W. Laing, A. Constable & Co. and W. & J. Deas; and for Cadell & Davies, and Longman, Hurst, Rees, & Orme, 1808), vii.

[45] Ibid.

conditions of Great Britain. Robertson contended that Italy was "much warmer than it seems to have been in the time of the first Roman Emperors," and he offered in support of this contention examples of frozen seas and rivers from the classical texts of Diodorus Siculus, Ovid, Virgil, and Juvenal. The commonly held explanation for the disparity between past and (then) present conditions, Robertson noted, had been "imputed to the draining of marshes, the cutting down of forests, and putting the soil into a proper state of cultivation."[46] This relationship between cultivation and climatic change—particularly warming—would remain central to climatic theories throughout the nineteenth century. Robertson, as early as 1808, disputed this theory. While he acknowledged that Man's domination of nature might have in some places "a considerable influence in meliorating" the climate, Robertson also recognized that "in the days of Augustus the soil of Italy was in a much higher state of improvement than it has been for these many ages past"—despite the fact that the present climate appeared "to be much milder than it was during [Augustus'] reign."[47] In addition to this, he found that even early Roman historians like Columella, author of *De Re Rustica*, believed that the climate had been milder in the distant past. As such, Robertson concluded that natural historians "therefore cannot ascribe this alteration in . . . temperature to any circumstance connected with agricultural improvements."[48]

Moving ahead from the Classical Age, Robertson turned his attention to centuries directly preceding his lifetime. He argued that historical anecdotes of frozen seas

[46] Ibid., 155.
[47] Ibid., 155-56.
[48] Ibid., 156.

suggested "that the winters must have been much colder in Europe, even in latter times, at an æra not very distant from the period in which we live." Accounts of frozen surfaces along the Mediterranean, Baltic, and Adriatic Seas suggested harshly cold conditions in 775, 1668, and 1709, respectively, but not more recently.[49] Citing the geological studies of Kirwan, Robertson agreed that it "would appear also, that our highest hills were formerly covered with growing wood; which probably decayed with the diminished temperature of the climate." Robertson offered a correction, however, to Kirwan's explanation for this decrease in temperature as a result of the uplift of the land on which the trees were thriving. Pointing to the similar characteristics of the Nile Valley in both the nineteenth century and at the time of Herodotus, Robertson concluded that "we are not inclined to think, that any remarkable alteration of climate has occurred from this cause."[50]

Further evidence for a cooling climate could be unearthed through a comparison of agricultural products during his era and during that of the Middle Ages. "The decrease of the temperature of the climate of Britain," Robertson asserted, "is likewise evinced by circumstances connected with the agriculture of the country." Using evidence from historical records, he offered a compelling argument for a warmer medieval England. Like John Williams' *Climate of Great Britain*, Robertson discussed William of Malmesbury's twelfth-century account that abundant, superior wine was made from the English vine. Robertson, however, offered further evidence of

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[49] Ibid., 157.
[50] Ibid., 159.

agricultural change, thus helping distinguish his work, ever so slightly, from other accounts. He explained that, during the July, 1298, siege of Dirleton Castle, soldiers sustained themselves on nearby fields of peas. This, Robertson suggested, "gives a pleasing idea of the agriculture of East Lothian at that early period," and one different from that of his day, in which "peas do not ripen in the same fields till fully six weeks later."[51] Although Robertson discussed other examples of agricultural disparities between the past and the present period—apples, for example—his identification with the arguments previously posited by John Williams suggests that not all found Williams' arguments quite so far-fetched as his dismissive critics might have hoped.

Robertson may also have identified, though not explicitly, an additional warm period which preceded the present yet followed that of the Middle Ages. Following an inspection of Scottish records, Robertson concluded "that wheat was formerly paid to religious houses from lands where it is now impossible to raise that grain, and where it has not been attempted for nearly these 200 years."[52] Two-hundred years prior to 1808, of course, places one rather close to the commencement of the Little Ice Age, as defined by some. Although Robertson delineated no clear periods, he offered additional evidence of a two-century period. He found it "evident, that the climate of Britain has suffered a considerable change within these two last centuries." Robertson also offered glacial and agricultural evidence from M. De Luc, the Abbé Richard, and the anonymous author of an article in the *Journal de Physique* as evidence of a different climatic regime

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[51] Ibid., 160.
[52] Ibid., 161.

in the preceding two centuries. It is important to note, though, that Robertson did not believe such alteration necessarily implied a change in average annual temperature. He instead suggested that the harshness of both summers and winters had abated over the preceding "fifty or sixty years."[53]

Although Robertson discussed, at length, evidence for a changing climate, he did not attempt to offer an absolute explanation for why such changes had occurred. This is not to suggest that he was unaware of the theories of others; quite the contrary, he addressed the suggestions of many budding climatologists. Robertson found some sort of problem with each of these explanations, which ranged from the effects of cultivation to the precession of the equinoxes. The explanation he found most favorable, it seems, was that of the locations of the planets. The "seasons," he noted, "undergo changes corresponding to others recurring at certain periods, and which seem to be produced from the connection of the globe with other planets."[54] The utility of this explanation was not based upon specific arguments of *how* such connections operated on the climate, it was based upon its ability to account for seemingly periodic, rather than random, alternation. Robertson contended that climates "probably undergo an alternate increase and diminution of temperature for a certain period of years." This period, based on Robertson's readings of classical and modern theorists, appeared to consist of a "revolution of six hundred years."[55] If this revolution is literal, and includes *both* warmer and cooler—or at least milder and harsher—conditions, then it is the first

[53] Ibid., 162.
[54] Ibid., 171.
[55] Ibid., 172.

identification of the two periods that would come to be known as the Medieval Warm Period and the Little Ice Age.

Dr. Robertson's *Natural History of the Atmosphere* is rather unique among the early investigations of climate addressed thus far. Robertson sought to understand climatic change through transnational, transoceanic comparison, and he attempted to do so by drawing on both his own research and that of scholars far afield. Robertson was clearly aware of John Williams' *The Climate of Great Britain* because he addressed Williams' acceptance of the correlation between climatic change and cultivation. But the depth and breadth of Robertson's investigation, with its overt discussion of decadal and centennial-scale climatic change and its identification of the medieval and early modern climatic periods that would in time gain proper names, elevate it to a position far closer to the work of the mid-twentieth century than to that of its contemporaries. This, in only one chapter; had Robertson dedicated his entire book to the subject, he might have personally advanced the study of the history of the climate by more than a century.

Robertson's peers were not particularly impressed. A lengthy review in *The Medical and Physical Journal* made no mention of Robertson's conclusions about climatic change—except in a laundry-list of subjects covered in the two-volume work.[56] This may befit a journal dedicated primarily to medicine; much of the review is actually a critique of Robertson's assertions about climate and disease. But it also suggests that Robertson's conclusions about climatic change were not terribly earth-shattering to the

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[56] "Critical Analysis of the Recent Publications on the Different Branches of Physic, Surgery, and Medical Philosophy," *The Medical and Physical Journal* 20, no. 116 (October 1808): 365.

learned minds of his time. A review the following year in *The Literary Panorama* offers further evidence that Robertson's conclusions were not recognized as remarkable.[57] Nothing in the discussion of Robertson's chapter on climatic change suggests that the reviewer was surprised by its novelty. The only criticism, good or bad, was a contention that Robertson had "confounded two distinct theories," that of Dr. Williamson and that of John Williams—the former suggesting that cultivation brought mildness of climate, the latter, the opposite.[58] The reviewer believed that Robertson had not attended to these two theories with sufficient care. Nevertheless, the review found that the "work contains much valuable information," even if "persons conversant with the subjects comprised in this treatise, will find few topics with which they have not, by reading or observation, been previously acquainted."[59]

In retrospect, two possibilities suggest themselves: either Robertson's nascent concept of climatic periods was just that—nascent and thus unrecognized, or it meshed well enough with extant ideas that it invited no critics. To a certain extent, both may be true. It has been argued here that the concept of climatic regime was not created *de novo* in the twentieth century, but instead drew on ideas circulating throughout the West for several centuries. But it may also be the case that the unique specificity of Robertson

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[57] "Robertson's *General View of the History of the Atmosphere*," *The Literary Panorama, Being a Review of Books, Magazine of Varieties, and Annual Register; Comprising Interesting Intelligence from the Various Districts of the United Kingdom; The British Connections in the East-Indies, the West Indies, America, Africa, Western Asia, &c. and from the Continent of Europe, Austria, Denmark, France, Germany, Greece, Holland, Hungary, Italy, Poland, Portugal, Prussia, Russia, Spain, Sweden, Turkey, &c*. 5 (March 1809): 1123-31.

[58] Ibid., 1127.

[59] Ibid., 1130.

granted to climatic periods did not become truly apparent until later authors applied to them the titles *Medieval Warm Period* and *Little Ice Age*.

Following the investigations of Williams and Robertson, Hugh Williamson offered his observations on American—and to some extent, global—climate. Williamson noted the recent moderation in American climate, writing that it "is well known, that in the Atlantic States, the cold of our winters is greatly moderated." Williamson ascribed this warming to cultivation: as "the surface of the country is cleared, a greater quantity of heat is reflected" and "the air becomes warmer," thus blocking the north-west winds. Mechanics aside, Williamson offered lessened snowfall and unfrozen rivers as proof of this warming. "It is generally admitted," he wrote, "that in Massachusetts and New-Hampshire, the quantity of snow that fell, during the winter, fifty years ago, was more than double of what has fallen, in any winter, for several years past." Furthermore, he noted that the Delaware River "used to be frozen by the middle of November; but of late it has seldom been frozen before Christmas; and there are winters in which it is never frozen across."[60] As part of a response to "those philosophers of partiality or prejudice, who mention the coldness or our climate as a proof that America has lately emerged from the ocean," Williamson offered evidence that Europe, too, had once been colder than it was at present. Since there were no theories that the "old continent" had arisen from the sea—at least, "of late"—there

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[60] Hugh Williamson, *Observations on the Climate in Different parts of America, Compared with the Climate in Corresponding Parts of the Other Continent. To which are Added, Remarks on the Different Complexions of the Human Race; with Some Account of the Aborigines of America. Being an Introductory Discourse to the History of North-Carolina* (New York: Printed by T. & J. Swords, 1811), 9.

seemed to him to be little need for following such oceanic reasoning in regard to the New World, either. Williamson asserted that "we can mark the period when the winters in Asia and Europe were as cold, perhaps colder, than they now are in corresponding latitudes in America."[61] Williamson's concern, though, was not so much with the centuries immediately preceding his own; the references he offered were of a decidedly classical bent. Based on anecdotes form Juvenal, Horace, and Virgil, Williamson concluded that the "winters must have been very cold, seventeen hundred years ago, in Italy."[62]

The Reverend Edward Polehampton also weighed in on the subject of climate as part of his six-volume explication of nature, science, and creation. Polehampton offered a perspective of the dominant theories of climatic change under discussion in 1815. He noted that "[s]ome philosophers have supposed the earth to become progressively warmer in the course of ages, while others have imagined that its heat is exhausted." Polehampton found neither of these uniform positions probable. He reasoned that an increase in received heat would result in an equal increase in emitted heat. Such a balance did not, however, preclude regions from experiencing alterations. "Local changes," he noted, "may indeed arise from local circumstances." Such circumstances helped to explain, as a result of cultivation, the fact that "the climate of America is said to have become considerably warmer," while also allowing for the fact that, "to judge from the descriptions of the ancients, it appears that even in Europe the winters were

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[61] Ibid., 17.
[62] Ibid., 18.

formerly much colder than they are at present."[63] As Polehampton explored this relationship he stumbled upon important contradictions. Although the supposed relationship was apparently useful in explaining the changing conditions in America, it failed to explain the conditions in Ireland, where temperature had increased though cultivation had not. Polehampton concluded that "the cultivation or neglect of the soil does not seem in every instance to constitute the actual cause of this difference in the temperature."[64] That climate had changed, however, Polehampton had no doubt. Nor did he believe himself to be in the minority in recognizing this change. The idea had "frequently been started," he asserted, "that the temperature of several, perhaps of all climate, has varied at different epochs, and is in truth perpetually varying; in some instances for the better, and in others apparently for the worse."[65]

Although much discussed during this period, the subject of the climate remained hampered—even in 1815—by a continuing problem of definitions. One scientific dictionary continued to trumpet the classical definition, but, like historian George Costard, it also acknowledged the existence of a "vulgar" usage of the term. Climate, the dictionary asserted, was "a part of the surface of the earth bounded by two lesser circles parallel to the equator; and of such a breadth, as that the longest day in the parallel nearer the pole exceeds the longest day in that next the equator, by some certain space, as half an hour, or an hour, or a month." When used vulgarly, however, it might

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[63] Edward Polehampton, *The Gallery of Nature and Art; or, A Tour through Creation and Science*, vol. 4 (London: R. Wilks, 1815), 44.
[64] Ibid., 47.
[65] Ibid., 46.

refer to "any country or region differing from another either in respect of the seasons, the quality of the soil, or even the manners of the inhabitants," regardless of the lengths of their days.[66] The dictionary suggested that Arabic scholar Abulfeda may have made the first real distinction between the two concepts through his usage of the terms "Real Climates," for latitudinal climates, and "Apparent Climates," for those not based on length of day.[67] Despite the increasing awareness that more than mere lines on the globe determined the climate, continuing definitional problems such as this likely hampered the widespread adoption of new theories and may help explain the reticence some reviewers had for taking seriously the contentions of the many authors engaging climate during the period between 1780 and 1820.

By the beginning of the nineteenth century, natural philosophers and historians had developed a study of climate, and the first outlines of a historical understanding of climate, to a degree far more similar to the works of the present than to those of the medieval era. Although there remained much reliance on climate as an explanation for human character and temperament, it is the rare account that did not include some exceptions to such a rule. To a great extent, concepts of causation and agency were dynamic and collaborative, incorporating elements of religion, social structures, economic processes, and political events into environmental theories. Climates, even

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[66] Charles Hutton, "Climate," in *A Philosophical and Mathematical Dictionary: Containing An Explanation of the Terms, and an Account of the Several Subjects, Comprised under the Heads Mathematics, Astronomy, and Philosophy Both Natural and Experimental; with an Historical Account of the Rise, Progress, and Present State of These Sciences; also Memoirs of the Lives and Writings of the Most Eminent Authors, Both Ancient and Modern, Who by Their Discoveries or Improvements Have Contributed to the Advancement of Them*, Vol. 1 (London: Printed for the Author, 1815), 327.

[67] Ibid., 327-28.

those not identified as "ideal," slowly came to be recognized as geographies of possibility rather than of condemnation; humans might choose to survive—and even thrive—in situations of greatly varying circumstances. As General Lincoln noted, some were even "really partial" to their circumstances![68] One of the last references to climate to be published in the eighteenth century—a passage of no unusual significance—is illustrative of the era's changed understanding of climate, a change from one that posited it as a sort of *deus ex machina* or held it as tenet of philosophy to one that incorporated climate into the complex experience of daily life:

> An European who contemplates moving to America, has a vast field before him. The United States offer a variety of soil, climate, and people: it is difficult to select from these the situations most comfortable to his opinions and habits. That country where the climate requires exertion and industry to procure the comforts of life, and whose geographical situation admits of the produce of the country being easily transported to market, certainly bids fairest for having an orderly and well regulated government.[69]

Some of the scholars of this era even sought to carry the question of climate further by attempting to define climatic periods into which history might be divided. Henry Robertson's identification of a warm medieval period and a cool antecedent foreshadowed the "discovery" of these eras in the twentieth century, when scholars would grant them the proper names, *Medieval Warm Period* and *Little Ice Age*. Because of the unique contributions of the forty years addressed by this chapter, the era between

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[68] Lincoln, "Fishes," 460.

[69] [Charles Williamson], "Letter 5," in *Description of the Genesee Country, its rapidly pregressive Population and Improvements; in a Series of Letters, from a Gentleman to his Friend* (Albany: Loring Andrews and Co., 1798), 35, quoted in "Art. I," *The Medical Repository*, vol. 2 (New York: Printed by T. & J. Swords, 1799), 431.

1780 and 1820, and particularly the first decade of the nineteenth century, may be thought of as the first great age of climatic periodization.

CHAPTER IV

CLIMATIC CHANGE CHANGES THE DEBATE

The forty or fifty years bracketing the commencement of the nineteenth century were uniquely productive for the construction of climatic periods. Much like the second half of the seventeenth century, when natural scholars like Robert Hooke called for the systematic recording of climate, the early nineteenth century witnessed a veritable explosion in the attention paid to warm and cold periods. By 1810, the idea of a warm medieval era followed by a cooler period was engrained in climate theory, even though natural scholars had not uniformly endorsed it. The next few decades of the nineteenth century remained deeply concerned with the careful recording and reporting of climatic conditions; the numerous tables and accounts found in journals and books, like Luke Howard's *Climate of London*, attest to this.[1] With a few exceptions, acknowledgement of distinct climatic periods was not quite so common. By the 1840s and 1850s, however, natural scholars were again wrestling with periodic climatic change, and they continued to do so throughout the nineteenth century.

No one answer may satisfactorily explain why natural scholars did not maintain the initial burst in the study of historical climatic periods. Accessible documents may have been exhausted. To some extent, it may also have been the result of normalization

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[1] Luke Howard, *The Climate of London, Deduced from Meteorological Observations, Made at Different Places in the Neighbourhood of the Metropolis*, 2 vols. (1818; London: Published by W. Phillips, 1820).

and professionalization of meteorology. The era's increased emphasis on careful recording and standardized instrumentation, with extant skepticism of medieval monks and vintners, may have combined to turn the attention of meteorologists to the measurement of the present, thus restricting the talk of periodization. This, however, fails to completely account for the attention provided the subject after midcentury. One of the characteristics that set the nineteenth century apart from the other centuries in which climate was a source of extensive examination was the presence of significant climatic change. The 1820s and 1830s experienced brief episodes of both warming and cooling which imposed a contemporary influence on the historical debate. It was more difficult to recognize the existence of multi-decadal or centennial climatic changes when the climate seemed to vary annually. By the end of the nineteenth century, however, it was apparent that both a real alteration in conditions had occurred and that this alteration was linked with changes of the past.

Recognition of the warming that signaled the end of the cool, post-medieval era represented an important shift in meteorology. Included now within the corpus of scientific knowledge were anecdotes of diametrical climatic trends—cooling after the Middle Ages and warming in the present. Both of these were of recent, rather than ancient, occurrence; both were subject to some degree of record-keeping. Recognition of this was a slow process; few investigations initially recognized both climatic changes, and an additional series of harsh winters temporarily put to rest the talk of warming. Over time this changed. While some continued to posit unidirectional temperature and moisture trends, it was harder to do so with any intellectual honesty. The end result was

a transformation of the perspective of climatic change, which became a more immediate concern than it had been in most of the analyses of the past. Those seeking evidence of climatic change no longer had to rely on medieval accounts for evidence of alteration; they needed only to note the accounts of contemporary glacial recession. Not only were ideas of climatic change transformed, so too were ideas of "good" and "bad" climates. The locus of the so-called ideal climate had shifted to the present, with all the consequences that accompanied this new reality. The acceptance of both climatic cooling and warming within recent historical times was one of the most important developments in the history of climate. It was a paradigm shift.

Horticulturist Andrew Knight offered one of the more notable exceptions to the relative paucity of investigations of climatic change during the early years of this transformative era in a paper he read before an 1829 meeting of the Horticultural Society. Knight's essay was an account of a newly *warming* climate, similar to that suggested by almost all modern definitions of the Little Ice Age, though probably two decades too early. Knight strongly believed that Europe had warmed considerably in the preceding decades, and he suggested that this had become a rather common belief:

> There are, I believe, few persons who have noticed, and who can recollect, the state of the climate of England half a century ago, who will not be found to agree in opinion that considerable changes have taken place in it; and that our winters are now generally warmer than they were at that period.[2]

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[2] Andrew Knight, "Upon the Supposed Change of the Climate of England," (paper read before the Horticultural Society May 5, 1829), in *A Selection from the Physiological and Horticultural Papers, Published in the Transactions of the Royal and Horticultural Societies, by the Late Thomas Andrew Knight, Esq., President of the Horticultural Society of London, Etc. Etc. To Which is Prefixed, A Sketch of His Life* (London: Longman, Orme, Brown, Green, and Longmans, 1841), 307.

Knight took such sensate evidence seriously because of its suggestion that the climate was warming, rather than cooling. He did not believe that memories of a warmer past were likely to be accurate because of the effect of age on sense of warmth. Since many apparently believed that the past had been *cooler* than the present, he found the assertion valid. From his own experience, Knight had "no doubt whatever . . . that our winters are generally a good deal less severe than formerly . . . and our autumns considerably warmer."[3] He suggested that this warming was the result of cultivation, which had cleared "extensive tracks of ground" over the preceding half-century and, consequently, had altered the degree of moisture in the soil.[4] Cooler springs, though, accompanied this autumnal and wintry warming. As a horticulturalist Knight recognized the threat such changes presented to the growers of certain cultivars. Whether climatic change "be owing to the preceding or other causes," he felt "most perfectly confident that the weather in the spring has been considerably less favourable to the blossoms of fruit trees, and to vegetation generally, during the last thirty years, than it was in the preceding period of the same duration."[5]

While questions of climatic change swirled within the ether of the public sphere, pushed hither and thither by battles over sources, data, and general philosophy, religious figures continued to wrestle with its reality and relevance. The debate attracted, in 1833, the attention of the Religious Tract Society's *Weekly Visitor*. The author of a brief article explained that, "[s]o great is the influence of the atmosphere upon human health

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[3] Ibid.
[4] Ibid., 308.
[5] Ibid., 309.

and enjoyment," an "inquiry into its changes and their causes, can never cease to be an object interesting to man."[6] Of particular interest was "the question whether, of late years, the seasons have not lost much of their original regularity, and the climate itself suffered a very material and discouraging deterioration." Although the author recognized the impact of "human agency" on climate, he was primarily concerned with natural climatic variation. Such an alteration would be a change "of a formidable nature, totally independent of human power, and calculated to fill the hearts of those who cherish the fear of it with terror and dismay."[7] The author, however, dismissed these fears. It should come as no surprise, in the end, that a religious society addressed the subject of climatic change—capricious natural conditions suggested the judgment of a capricious deity. Referencing the investigations of François Arago, the author of the *Weekly Visitor*'s article celebrated the stability of Creation:

> His register is carried as far back as the century preceding the christian era; and from the whole he infers, that in Europe in general, and in France in particular, the winters were, some centuries ago, at least as severe as we have known them, and that the climate on the surface of the earth has not undergone any deterioration; thus far setting at rest the fears of those who, from partial observations, have been too credulous in giving way to them, and at the same time confirming, by positive evidence, our faith in the promise of Him who has declared, that "while the earth remaineth, seed-time and harvest, summer and winter, shall not cease."[8]

One of the most detailed examinations of the midcentury—from a contributor to *The Farmer's Register* identified only as "S."—seems to support the assertion that contrasting ideas about warming and cooling were in conflict between 1815 and 1835.

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[6] "Change of Climate," *The Weekly Visitor* 16 (April 2, 1833): 134.
[7] Ibid., 135.
[8] Ibid.; Genesis 8:22 (KJV).

Noting that an "extraordinary winter" had not long passed, S. wrote that it seemed appropriate to examine "the state of the seasons and weather at the earliest periods of our history." S. argued, as an opinion long-held, that "the common idea about a permanent change of our climate from cold to a warmer temperature, is a mistaken one." As a defense of this assertion, S. suggested a brief investigation of whether "the weather 200 years ago was not, for a series of years, about the same kind of weather which we have had for the last 25 years."[9] Drawing on both recent and past anecdotes, S. contended that those who had held an opinion that the climate was moderating had merely failed to experience the winters of the preceding decade. It seemed to S. that "this alleged change of our climate is altogether ideal, and has no foundation in fact" when judged "from historical data." There were, at the time of S.'s writing, "the same kind of seasons experienced here 230 years ago;" some were "uncommonly cold," while others were "very moderate." There was nothing climatically remarkable about either the past or the present—only individual years deserved particular attention. S. contended that "so far from the winters being shorter and less severe than formerly," it could not "be shewn by recorded facts, or by the memory of man, that there ever was before in this State, a succession of such severe winters as have occurred since 1829."[10]

S. also found a great contradiction between memories of harsh winters and frozen rivers and the actual records of their characteristics. Extrapolating from Pennsylvania

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[9] S., "Notices of the Seasons in Olden Times," *The Farmers' Register, a Monthly Publication, Devoted to the improvement of the Practice, and Support of the Interests of Agriculture* 4, no. 4 (August 1836): 247.

[10] Ibid., 248.

records, S. concluded that there was "abundant reason to believe, that the accounts given in other States of the great severity of the winters in olden times, are equally devoid of correctness." The reason for this failure of memory, S. asserted, was that "the moderate winters were forgotten," while "the very cold ones made a lasting impression on the memory"—much as the received history of the ancient world consisted not of accounts of peace, but "only of *wars*."[11] Although S. offered an important critique of the theory of historical climatic change, predicated on the understanding that there might be a disparity between memory and reality, S.'s rejection of climatic change was incomplete. The unnamed contributor did not address the question of why there were *so many* references to harsh winters in the past, or whether the harsh winters of the preceding decade were unusual. Despite S.'s conclusions, the brief article is evidence that the question of a moderating climate was close to the minds of many people, appearing in a journal devoted to the practice of farming rather than philosophy, and appearing, as it did, between two articles on beet sugar.

By the end of the 1830s, historical analysis of climatic change came back into favor. An 1837 abridged translation of an article by Arago investigated localized climatic changes in Europe, but it offered rather uncertain conclusions. Exhibiting a lengthy table of the freezing of major rivers, Arago concluded that "I much doubt if any one, after studying this table, can find, in the phenomena of the congelation of rivers

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[11] Ibid., 250.

mentioned by classical writers, any *proof* that the climate of Europe has deteriorated."[12] This admirable though imperfect attempt to use the historical record to measure climatic change should be recognized, but the limitations of the data preceding the thirteenth century and during the fifteenth century greatly weaken the argument. Arago did not, however, reject the idea of climatic change outright. The changing nature of European viticulture was central to the discussion of more recent alterations in the climate. The history of *Mácon* suggested "that in 1552 or 1553 the Huguenots retreated to Lancié . . . [and] drank the *Muscat wine of the country*," an event impossible in 1837 as "the Muscat grape does not ripen sufficiently in the *Máconnais* to admit of wine being made from it." This is both an important piece of evidence and an important argument as it suggests that the mid-1500s, like the Middle Ages, were conducive to the production of wine in regions at times incapable of it. Arago found similar records of successful vineyards in England equally convincing. Such a difference between the past and present were "enough to convince the most incredulous, that in the course of centuries, the summers, both in France and England, have lost a proportion of their temperature;" it remained "to seek the cause of so alarming a phenomenon."[13]

The Americas, however, offered a key to this perplexing question. Recently settled and—presumably—recently cultivated, America was a land which in the nineteenth century was "undergoing these same modifications, under the eyes of an enlightened population." Arago asserted that "[t]hroughout all America," it was

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[12] François Arago, "On the Internal heat of the Globe, and Its Influence on Climates," *The Magazine of Popular Science and Journal of the Useful Arts* 3 (1837): 186.

[13] Ibid., 191.

"agreed, that clearing and cultivation have modified the climate, and that the change becomes more and more manifest; *the winters are less severe, and the summers less oppressive*: in other terms, the extremes of temperature observed in January and July approach each other, from year to year."[14] Whether the author believed the climate had warmed or cooled is not clear; in truth, the argument offered suggests only that conditions had moderated. It remains important to note, however, that assertions of both warming and cooling occurred within the same argument.

The 1840s saw a veritable explosion in the discussion of climatic periodization. The specter of fine British wine remained central to the problem. In a brief article of 1840, an author identified only as R. W. R. addressed recent changes of climate and shared in the concerns expressed by many of its prior critics. R. W. R. suggested that the very specificity of viticulutral anecdotes was testament to their insignificance; the few available examples of grape cultivation were truly exceptional. "[T]he very indication of a few vineyards here and there," the author wrote, "excludes the idea of any extensive cultivation, such as takes place in really wine-growing countries." R. W. R. also referenced William of Malmesbury's account of the British vine, noting that it was the only passage "quoted that would at all seem to imply an extensive cultivation of the vine in ancient times." Even this account, though, was "too vague to allow of any positive conclusion."[15] R. W. R. was adamant that proof for a change of climate could only be

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[14] Ibid., 192.

[15] R. W. R., "Observations on the Climate of Italy and other Countries in ancient times," *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science* 17, no. 108 (August 1840): 101.

found in a great change of viticulture in Britain—not a minor one. As evidence that such a change had not occurred, the author pointed to multiple anecdotes from both the present and the past of the production of middling quality British wine. R. W. R. concluded his discussion arguing that Britain had not been warmer in the past than at present:

> This idea rests solely on the cultivation of the vine in this island; a fact which cannot be disputed, but does not, I conceive, lead to the inferences that have been drawn from it. The testimony adduced merely indicates a very local and partial cultivation of the plant; such, in fact, as numerous experiments have shown to be practicable in recent times.[16]

R. W. R.'s assertion was strengthened by the recognition of limited, contemporary cultivation, but the overall argument failed to account for examples of climatic change offered by other theorists, like excessive snow, sea ice, or frozen rivers.

Others defended the theory of unique climatic periods. Writing at the end of the 1830s and the beginning of the 1840s, Luke Howard—of earlier meteorological fame—left little question about his position on the subject. He asserted that it was a "fact, now fully ascertained," that there existed "periodical variations *in the temperatures of the years and seasons* in our own Climate."[17] Howard's explanation of the workings of climate identified "*the nature of the surface*" as an important modifying factor. This factor included the relationship between cultivation and climate. Howard contended that "[c]ultivation of the soil tends to make a more *uniform* Climate" by taking "down somewhat the heat of summer" and tempering "the winter's cold." While the "*mean*

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[16] Ibid., 102.

[17] Luke Howard, *Seven Lectures on Meteorology*, (1837; repr., London: Harvey and Darton, 1843), vi.

heat" of England was probably the same as that of the Roman era, cultivation and the clearing of forests had conspired to alter the interaction between the land, the sun, and the atmosphere. Howard's arguments, however, were contradictory. He recognized the prior existence of English vineyards, but he also believed that, because the island was then more heavily forested, it had to be cooler. Howard wrote that there were "circumstances in its History, which may make us suspect that, for some space in subsequent but early times, when the greater part was yet covered with forest, there existed *sheltered spots of peculiar warmth and fruitfulness*, (now exhausted and laid open) in which even the vine was cultivated on the great scale with success."[18] Reports of similar changes in North America encouraged Howard in holding such a position.

As he moved ahead chronologically, however, Howard revealed himself as a supporter of the idea of short-term climatic cycles. Howard came to this conclusion between the publications of the first and second edition of his collection of lectures. Making use of temperature records not unlike those longed for in the 1660s, Howard settled upon an eighteen year cycle of temperature. In the notes accompanying his third lecture, he wrote:

> The seasons appear to run through their full variation, in this respect, *in Eighteen years*—the former *nine* of which, as comprehending seven years of a temperature above the mean, may be called *The Long Summer*; and the latter nine, having seven years below the mean, *The Long Winter* of these islands: not that the effects are so confined, the like season prevailing to a great extent, in like succession, in the European continent also.[19]

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[18] Ibid., 43.
[19] Ibid., 178n"c".

Despite his exciting discovery, Howard cautioned against "propos[ing] a full and definite theory on this subject" until observations had been "more extensively examined and compared."[20] Howard's discussion of climatic periods demonstrated a new development in climatology, and one intimately related to the subject of the present narrative: he granted proper names to climatic periods. Although he intended the names be reusable rather than unique, his contribution to the formalization of climatic periodization was no less significant.

Recognition of climatic change was not limited to the English-speaking world. French investigation and publication was central to the development of new ideas about the climate, its changes, and its periodization. Joseph Fuster's 1845 *Des changements dans le climat de la France* was one such important contribution during this crucial decade. Fuster's purpose was not merely to write about climate, but to answer a very specific question: "Le climat de la France a-t-il changé et change-t-il?"[21] Fuster determined that "[l]e climat de la France a changé et change journellement." He explained that "[l]a nature et l'homme travaillent sans relâche et en commun à hâter ces changements." Fuster traced the history of the French climate from the early writings of Caesar, through the Dark and Middle Ages, to the present era while seeking to ascertain the facts and mechanisms of climatic change. Rather than relying on one or two sources from relatively circumscribed locations—as many in England had done when discussing viticulture—Fuster drew upon sources from many different years and locations in

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[20] Ibid., 48.

[21] Joseph Fuster, *Des changements dans le climat de la France: Histoire de ses révolutions météorologiques* (Paris: Capelle, 1845), i.

France. His conclusions about climate were formed in an intellectual milieu that did not yet recognize climatic change as a natural process. Fuster acknowledged that "ces faits et leurs corollaires, communiqués à l'Académie des sciences, ont trouvé des contradicteurs."[22] Adrien de Gasparin was one of the foremost critics of the idea of climatic change. De Gasparin had long held that "[l]es saisons ont un caractère d'immutabilité permanente, et leurs variations en plus ou en moins ne sont que des oscillations autour d'un point fixe."[23] "Les saisons," he believed, "ont un cours régulier, permanent, dépendant des lois générales de l'univers, et par conséquent immuables comme elles."[24] Fuster remained unshaken by such criticism.

The organization of Fuster's chapters suggests a developed understanding of the periodization of climate. He identified the era prior to Christianity as a period in which Gaul experienced "un froid excessif."[25] The coolness of this era loosened its grip in the centuries following the establishment of Christianity. The Middle Ages were the beneficiary of this change; Fuster suggested that "[n]otre climat mit cinq cents ans à s'échauffer d'un bout à l'autre de proche en proche." Fuster identified this as the third phase of climate in the historical era. The significance he placed on vineyards for understanding the characteristics of this period is immediately apparent; even the chapter title acknowledges this: "Du Climat de la France pendant le Moyen Age. Étendue de ses

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[22] Ibid., 1.
[23] Ibid., 49; originally from Adrien de Gasparin, *Mémoire sur la culture de l'olivier* (1822), première partie, chap. II.
[24] Fuster, *Changements*, 236.
[25] Ibid., 53.

Vignobles."[26] This period of vine-friendly weather was not to last; during the twelfth through the fourteenth centuries, conditions declined and vineyards took their leave of some regions.

Although Fuster did not discuss at length the fifteenth and sixteenth centuries, he did note the deterioration of subsequent centuries: "Le climat de la France continua à se détériorer du nord au sud pendant les dix-septième et dix-huitième siècles." Agricultural changes were evidence of climatic changes. One example of this was the fact that "la Picardie renonça à ses vins, sans en excepter le vin royal de Coucy." In addition, "la Normandie et la Bretagne abandonnèrent aussi de plus en plus les débris de leurs anciens vignobles," and "les vins des environs de Paris perdirent insensiblement tout leur crédit."[27] Fuster's investigation of climate included both analysis and chronology of inclement conditions, thus incorporating features commonly found in completely separate styles of meteorological history. His conclusion, having investigated the evidence of climatic change in the centuries preceding his writing, suggests that the evidence had left him with little uncertainty on the matter:

> La reproduction fidèle d'un ensemble de faits reconnus par les contemporains, et garantis par des actes officiels, résout la question des changements de ce climat en faveur de ces changements; elle établit, en effet, que le climat de la France a changé et change encore dans toutes les direction et sur tous les points.[28]

Although Fuster utilized a more diverse selection of sources than many of his predecessors and wrote a more lengthy and detailed analysis of climate than almost any

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[26] Ibid., 112.
[27] Ibid., 41.
[28] Ibid., 49.

previous meteorological historian, his work failed to convince all of his critics. Ludovic Lalanne, in an 1846 review, found Fuster's investigation wholly unconvincing. "Rien," he concluded his critical review, "dans les renseignements fournis par l'histoire, n'autorise à supposer que, depuis la conquête romaine, le climat de la France, en général, ait été sensiblement modifié." He concluded: "Ces conclusions sont de tout point contraires à celles de M. Fuster."[29]

French and English scholars were not the only parties interested in the subject of climatic change in the 1840s. German scholarship made important contributions to the field, as well—important enough, in some cases, to warrant translation into English for publication in Great Britain. One such contribution was Franz Meyen's *Outlines of the Geography of Plants*, an investigation of botanical geography concerned with the relationship between climate and natural and domestic flora. Meyen addressed the history of the vine, *Vitis vinifera* L., because the "distribution of the vine over the globe is of particular importance to mankind."[30] Much of his discussion of the grape was related to its varieties, extent, and usage, but he also attended to its relation to the natural world. Meyen contended that summer temperature, rather than the annual mean, was responsible for the distribution of the grape: "it is chiefly the length of the summer which influences the ripening of the fruit."[31] Many had ascertained from the

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[29] Ludovic Lalanne, review of *Des changements dans le climat de la France, Histoire de ses révolutions météorologiques*, by Joseph Fuster, *Bibliothèque de l'école des chartes* 7, no. 1 (1846): 466.

[30] Franz J. F. Meyen, *Outlines of the Geography of Plants: With Particular Enquiries Concerning the Native Country, the Culture, and the Uses of the Principal Cultivated Plants on Which the Prosperity of Nations is Based*, trans. Margaret Johnston (London: Printed for the Ray Society, 1846), 367.

[31] Ibid., 370.

abandonment of viticulture that the conditions of such summers had changed. "We learn from history," Meyen wrote, "that at an earlier period there were vineyards in these parts [northern Europe], which probably were again deserted 300 years ago."[32]

Meyen did not, however, draw the same connection between the desertion of vineyards and climatic cooling as did some historians. It seemed to him "that the fact may be readily explained" by "how bad and sour the wine of our country is."[33] Meyen deferred to the same explanation that critics of historical climatic change had offered at the beginning of the nineteenth century: trade with regions that produced superior wine had ended production at inferior vineyards. "It is easy to understand," Meyen asserted, "that after the sweeter wines had reached these countries by the more ready communication both by land and water, the inhabitants gave up using their sour liquor."[34] Despite Meyen's careful attention to the present and past *distribution* of the vine, he made no attempt to address the potential that the *quality* of its fruit had declined over time, a fact which suggests that he may have been reasoning from a presupposition of climatic uniformity.

The construction of glacial theories by such nineteenth-century scholars as François Agassiz made the already hard-to-miss glaciers even more difficult to ignore. As it came to be understood that glaciers were dynamic rather than static, and that they might be related to climatic conditions, even brief accounts by travelers became important contributions to the history of climate. The Reverend W. G. Heathman made

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[32] Ibid., 373.
[33] Ibid., 373-74.
[34] Ibid., 374.

one such remarkable contribution in an 1855 account of his recent travels through Switzerland. Although his book provided a narrative of his entire journey, it also included some rather startling statements about climatic change and glaciers—statements that would be deemed revolutionary when expressed by others in the twentieth century. Heathman wrote that there was "abundant proof that the climate of the Alps, 200 or 300 years since, was not so rigorous as it is at present." He offered three articles of evidence to support this conclusion. The first of these were the "remains of the village on the Faulhorn," which had apparently been abandoned due to glacial activity on this mountain. This contention was supported by the second article of evidence: records from the church of Grinderwald suggested that the village at Faulhorn existed between 1561 and 1605. The third article confirming Alpine climatic change was the bell of Grinderwald, which bore upon it an inscription dating it to "the chapel of Petronella, which stood . . . on the higher glacier of Grinderwald."[35] None of this appeared to have come as a surprise to Rev. Heathman, who merely noted that glaciers, like rivers, sometimes must leave their original paths in search of new ones.

While the Rev. Heathman explored the ruins of Swiss villages and sought out records of weddings from the same, the idea of constructing climatology began to take hold in the United States. Author Lorin Blodget conceived of American climatology as a newly developing science, albeit one that required the collection of more data than other sciences and attempted to draw comparisons between periods with varying

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[35] W. G. Heathman, *Switzerland in 1854-5: A Book of Travel, Men, & Things* (London: Hope & Co., 1855), 143.

quantities and qualities of data. "It is yet a matter of doubt," Blodget admitted, "whether these accumulations, in their best form, afford any reliable basis for prediction."[36] Blodget came to similar conclusions as those presented in the initial sections of this research—that the latter half of the seventeenth century witnessed the "greatest activity" in the formation of "climatological laws" and methods of observation.[37] He believed that this energetic advance was short-lived; the technological and spatial limitations of the time hindered the collection of data sufficient for the formation of strong conclusions. The field of climatology soon "fell again into the position of a record mainly for the interest its startling phenomena gave," an "interest it will never fail to have" but not one favorable to its advancement. This period continued through at least 1840, and many of its publications were "confined to the disproof of popular fallacies."[38] Blodget's criticism of the era's climatological science may shed some light on the paucity of investigations of climatic change in the years following 1815. Although the present research indicates that Blodget was incorrect about the absence of important discoveries at the turn of the nineteenth century, it may be that the disproving of "popular fallacies" to which Blodget alluded occurred in an atmosphere suspicious of, if not hostile to, theories of climatic change and periodization.

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[36] Lorin Blodget, *Climatology of the United States, and of the Temperate Latitudes of the North American Continent. Embracing a Full Comparison of these with the Climatology of the Temperate Latitudes of Europe and Asia. And Especially in Regard to Agriculture, Sanitary Investigations, and Engineering. With Isothermal and Rain Charts for Each Season, the Extreme Months, and the Year. Including a Summary of the Statistics of Meteorological Observations in the United States, Condensed from Recent Scientific and Official Publications* (Philadelphia: J. B. Lippincott and Co., 1857), 17.

[37] Ibid., 19.

[38] Ibid., 20.

Blodget himself was unconvinced that the climate had undergone significant alteration during historical time. While he believed that natural forces and human cultivation were capable of influencing climate, he doubted that they had had a measurable impact. "The surface of the earth and its geological structure," he admitted, "have at some remote interval undergone great changes, but there are none now in progress which are sufficiently important to influence the climate in any degree." Blodget's understanding of causation was fixed between natural and human: "the surface controls the character of the atmosphere fully as much as the atmosphere controls the surface or more, otherwise the greater agency would gain until it produced entire conformity."[39] Blodget clearly came down on the side of historical uniformity, an important, though fading, element of climate theory into the twentieth century. "For the whole of the vast historic period," he asserted, "there have been the same deserts in Africa and Asia, the same absence of water in the rocks and soil, and the same capacity for excavation and occupation of their quarries existed in the most ancient time as now."[40]

By holding this position, Blodget placed himself at odds with many natural scholars, but he had little faith in the contributions of chroniclers and historians in the first place. Blodget believed that "[r]eal history would be more valuable than anything else if it could be relied on, but there is great looseness with much exaggeration in everything dating back beyond the use of instruments." Such "loose" historical

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[39] Ibid., 482.
[40] Ibid., 483.

accounts, obviously, had been at the center of discussions about climatic change for more than two centuries and, to some extent, since the first historical texts of Greece. Blodget admitted as much, critically noting that such accounts "have been in turn quoted by . . . those who discredit their evidence of change of climate, and by . . . [others] in proof that more or less of change of climate has taken place."[41]

Like other critics, Blodget criticized historical anecdotes of warmer climates as being narrow, unrepresentative, and thus of little use in ascertaining the big picture. He explained away references to the supposedly clement climate of medieval Greenland, Iceland, and Vinland by such reasoning. In a difficult-to-follow argument, Blodget suggested that the accounts of Vinland were "very clear proof that but one locality of vines was found, and that the rarity of the growth . . . originated the term,—not any especial adaptation of climate beyond the present capacity of being favorable spots at that latitude to produce wild vines." Blodget elaborated:

> The structure on which so much speculation in regard to causes of the change of climate has been based wholly disappears on examination, and on the contrary, we learn that the Northmen found the New England coast eight hundred and sixty years ago quite precisely the same in climate as now—wild vines growing in a very few of the most favored spots, and only in these.[42]

Using the same limited information he had already dismissed, Blodget drew conclusions equally as wide as those he criticized. Though his suggestions were at odds with those of *historians*, Blodget concluded that *history* "is decisive that Europe in the middle

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[41] Ibid., 484.
[42] Ibid., 485.

latitudes was no warmer, and the common historical references, indeed, cite much colder winters in Germany and about the Black Sea."[43]

While Blodget dedicated himself to disabusing climatology of the influence of historians—or at least those with whom he disagreed—the subject of historical climatic change and its impact on agriculture began to intrude more apparently upon the public sphere. Seeking a subject to write upon, the editor of the "New York Literary Correspondence" in *The Ladies' Repository* noted that "*the weather* is the most natural theme for remark." "How much we are indebted," the author exclaimed, "to our variable climate for our civilization and social amenities!" In the opinion of the author, weather served as the ideal subject for conversation: it "has a very wide range, and everybody knows something about it, and all are interested in it." The author was primarily concerned, however, with a sense that the climate was growing warmer. The editors were "quite certain . . . that the record of the past few months will be a point of interest in the meteorological history of the age." Although the author recognized that it may be too soon to draw any conclusions from recent events, "it becomes us to be cautious." It seemed safe to say, however, "that the Januarys of other years were not after this fashion, nor can our winter be a long one." The force responsible for this change appeared to be a matter of much debate:

> But what is so strangely warming the atmosphere, is a question which every body asks, and nobody feels himself called on to answer. At other times we have heard of comets, which, acting like vast furnaces, seriously interfered with the calling of our terrestrial Vulcans; and again we have been told that the polar seas

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[43] Ibid., 486.

> have sent out their coolers in the shape of icebergs to temper our thermal excesses. Now, however, we learn that the Gulf Stream has run off its track, and is scouring along our coast, and making the experiment of heating our continent by steam.[44]

Of particular interest to the writer, however, was the economic potential this change carried, and the political consequences that would accompany such economic change. The author hoped that this might become "a permanent arrangement," thus allowing the northern region of the United States to "rival the 'sunny south' in cultivating the 'great staples,'" and gain with them some of the South's "chivalric fire." Noting, however, that this "might endanger the *Union*, and interfere with existing 'peculiar institutions,'" the author quickly changed the subject, finding it "wise not to meddle with such a 'delicate question.'" The significance of the statements found in the "New York Literary Correspondence" is threefold; they demonstrate non-scientific recognition that climate maintained the potential to change, that this change may have an impact on the structure of society, and that this change may be investigated as part of a "meteorological history."[45]

That nonscientific texts considered the subject of climatic change should not be surprising; the impact of climate on travel or daily life was a sensible concern. Its relationship to religion, though, is of particular interest to historians because of the window it opens upon some of the deepest thoughts of Man. It has already been noted that the Religious Tract Society weighed in on the matter in 1833, recommending that

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[44] [D. W. Clark], ed., "New York Literary Correspondence," *The Ladies' Repository* 18 (March 1858): 184.

[45] Ibid.

none should live in fear of climatic change—or what it might portend—since Arago had disproven such theories, affirming the promise of Genesis 8:22 that "while the earth remaineth, seed-time and harvest, summer and winter, shall not cease."[46] In 1866 the subject of climatic change made another appearance in religious discourse, this time in the *The Church Missionary Intelligencer*. The author identified some of the consequences ascribed to climatic change but questioned the tightness of the relationship between the two:

> There has been a blight on the potato plant, on the vine, on the mulberry-tree, and the silk-worm that feeds upon its leaves. The question arises, have atmospheric influences changed their nature? Are they different now from what they used to be? Has there been introduced into them some deleterious element, from which formerly they were free; and is it to this that we must ascribe the blights which have fallen on various forms of vegetable life?[47]

Much like the Religious Tract Society, however, the author refused to declare climatic change as either significant or even real. Instead it offered an opportunity to exhort people to turn from their wicked ways. "Or are these influences the same," the author asked, "while the plant has deteriorated, so that, because of its weakened tone and power, it is injured by that which in former days it met, not only without injury, but with advantage?"[48] Concern about climatic change was merely a sign of human weakness, a blight on human nature much like that on the potato plant:

> People may be seen seeking shelter from our English winter's cold in the warm nooks of our southern coast; and, even then, venturing forth only in the sunny hour, and protected by a respirator. Yet there was a time when these very

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[46] "Change of Climate," 135; Genesis 8:22 (KJV).

[47] "The Church and the Mission," *The Church Missionary Intelligencer, A Monthly Journal of Missionary Information* 2 (June 1866): 162.

[48] Ibid.

> persons cared nothing for atmospheric changes. It is not that our climate has changed, that our winters have grown more severe; but that the constitution of these persons has become enfeebled, and they are no longer able to bear exposure to the cold winds of heaven.[49]

The author thus projected his perceptions of English religion on the response of people to the climate. The "Romish" threat to English Protestantism was not a new development; it only seemed to be so because "the plant had become enfeebled in its constitution."[50] So it was with the uncomfortable climate. Or, at least, so the author presumed.

Interest in the American climate grew over the course of the mid-nineteenth century, much as it did in Europe. In 1867 John Disturnell attempted a new analysis of the conditions of the climate throughout the Americas. Disturnell believed that climate was "the most important and least understood of all the physical elements," and one which had been "strangely neglected by the scientific writers of the New World."[51] Disturnell was not convinced, however, that this important physical element had changed in recent history. He believed that it seemed "safe to infer that the mean annual temperature of Canada has not materially changed during the past three centuries."[52] Disturnell did not make a firm statement on climatic change in the United States, but his arrangement of quotations—concluding with arguments opposed to its existence—

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[49] Ibid.
[50] Ibid.
[51] John Disturnell, *Influence of Climate in North and South America: Showing the Varied Climatic Influences Operation in the Equatorial, Tropical, Sub-Tropical, Temperate, Cold and Frigid Regions, Extended from the Arctic to the Antarctic Circle. Accompanied by an Agricultural, and Isothermal Map of North America* (New York: D. Van Nostrand, 1867), ix.
[52] Ibid., 76.

suggests that he did not believe the American climate had changed, at least in the nineteenth century. His investigation of the Canadian climate did not extend further back than the sixteenth century, so his rejection of the theory of climatic change is not terribly surprising. Even his discussion of Greenland's climate did not extend into the medieval past, suggesting that Disturnell was primarily concerned with recent conditions.

While historical climatic change remained a fiercely debated topic, the idea of a uniformly cooling climate had not completely disappeared from climatic discussion. Despite the warming of the midcentury and the careful recording and reporting of temperatures and conditions, publications from the 1860s and 1870s continued to reference the threat of uniform climatic change. Some of these theories may most accurately be described as *wild*. Charles Dickens reported on some of the anticipated consequences of warming in December of 1866. The initial consequences of global warming were not believed to be particularly fearful:

> Rich herds would graze where now no human being can long brave the cold; the dove might build her nest in the wooded slopes of Hecla and the nightingale might yearly renew her song amid the tulip groves of Iceland, where now stretch vast wastes as silent as death and as barren as the mine.[53]

Soon, however, the seeds of destruction contained within this change would burst open, and a new threat would stalk the warming surface:

> [I]f this not very improbable change happened, the giant iguanadon might reappear on the wold, and the fish-lizard might again be the sanguinary tyrant of the ocean and the estuary; again the bat-lizard might cleave with dusky wings the

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[53] Charles Dickens, "Water Everywhere," *All the Year Round* 4, no. 85 (December 8, 1860): 204.

> dank and poisonous air of the tree-fern groves, and the turtle might once more spawn her eggs "where now the walrus sleeps and the seal is drifted on the ice-floe."[54]

Or so, as Dickens noted, "we are told."[55]

John L. Milton "borrowed" segments of Dickens' article for his discussion of climatic change. While he acknowledged the possibility of such warming, he was hardly a supporter of the idea. "If there be a chance, a possibility of this, there is a certainty that we are at present tending fast and steadily the other way." Milton believed that the "glacial period—the reign of winter in all its terrors" was coming, "and perhaps faster much faster than some writers think." He believed that the rate of cooling towards this "reign of winter" had "been increasing very much more rapidly within the last few hundred years and again still faster within the last half century."[56] As evidence of this climatic change, Milton cited the disappearance of some flora and fauna, including red deer and walnuts, from parts of northern Europe where they had thrived two hundred years prior. Although ascertaining the significance of Milton's stolen passage is problematic because of its comparability to earlier texts, his position on cooling in

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[54] Ibid. A dismissive account of strikingly similar language appeared in an edition of Charles Lyell's *Principles of Geology* as early as 1830. Dickens did not credit Lyell, and did use slightly different language, but it is probable that he either directly or indirectly borrowed the idea from Lyell's work. John L. Milton lifted the passage word-for-word, unattributed, from Dickens' text for publications in both 1866 and 1872. Whether or not Milton or Dickens believed such exaggerations to be commonly held is unknown, but since they did address the matter, it is assumed here they believed some still subscribed to it. See Lyell's disputation of such theories in Charles Lyell, *Principles of Geology, Being an Attempt to Explain the Former Changes of the Earth's Surface, by References to Causes Now in Operation*, vol. 1 (London: John Murray, 1830), 123; and John L. Milton, *The Stream of Life on our Globe. Its Archives, Traditions, and Laws, As Revealed by Modern Discoveries in Geology and Palæontology. A Sketch in Untechnical Language of the Beginning and Growth of Life, and the Physiological Laws which Govern its Progress and Operations* (London: Robert Hardwicke, 1866; [1872]), 577.

[55] Dickens, "Water Everywhere," 204.

[56] Milton, *Stream of Life*, 577.

Northern Europe during the preceding two centuries places his arguments squarely within the construct of a post-medieval cooling. Almost uniquely, however, Milton did not rely on viticulture to support his assertions.

While Milton concerned himself with the hopeless choice between iguanadons and a frozen Earth, others continued to wrestle with the disparity between ideas of climatic change and current data. Beliefs such as Milton's may not have been representative of common beliefs about climate, but the idea that some degree of climatic cooling had occurred was apparently common enough to warrant scientific debunking. The *American Chemist* reported on one such attempt in September, 1870:

> An examination of the temperature of New York City for twenty-five years was given by Prof. O. W. Morris, of the Cooper Union, the most marked point of which was to prove that the popular and prevalent impression that our climate is growing colder is totally untrue.[57]

Daniel Draper, director of the Central Park Meteorological Observatory, came to similar conclusions when he addressed the question of climatic change in an article for the readers of *The Popular Science Monthly*, the periodical that would eventually be known as *Popular Science*. Draper wrote that there existed a "popular belief that clearing of land, drainage, and other agricultural operations, tend to" modify the climate.[58] Draper did not dispute this theory. He believed it reasonable to assume that darker, ploughed land would heat up more than forest, but his investigation of the meteorological records of the northeastern United States did not uncover any important

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[57] "Brief Abstracts of Papers," *The American Chemist* 1, no. 3 (September 1870): 104.

[58] Daniel Draper, "Has our Climate Changed?," *The Popular Science Monthly* 1, no. 6 (October 1872): 668.

changes. While Draper admitted that Icelandic accounts of the vine have "been supposed to prove a change in the climate of New England during the last 800 years," his rejection of climatic change never actually addressed the vine.[59] He contended only that medieval descriptions of Atlantic forests bore great similarity to forests of the present.

Draper's opposition to the theory of recent climatic change was based upon two forms of data: thermometrical charts and records of frozen rivers. Neither recommended to Draper a significant alteration in the preceding century, and similar records of frozen rivers in Europe served as corroborating evidence. These American records, as well as their more lengthy European counterparts, did not extend beyond 300 years into the past, though, making it again unsurprising that they did not account for climatic changes before the mid-sixteenth century. The evidence Draper had collected did not, he believed, preclude the potential for climatic change; he vaguely explained that "there are brief cycles of heat and cold, of moisture and dryness, following each other under the operations of some unknown law, a law perhaps not of a meteorological but of an astronomical origin."[60] Despite Draper's uncertain disputation of climatic change, it is clear that he recognized, without unnecessary exaggeration, its potential consequences. "Not only is the settlement of this question interesting in a meteorological or scientific point of view," he wrote, "the sanitary, engineering,

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[59] Ibid., 669.
[60] Ibid., 673-74.

manufacturing, mercantile, and agricultural consequences are also of the utmost importance."[61]

The again blossoming subject of climatic change—which had already captured the attention of ministers, travelers, missionaries, scientists, writers, and the general public—continued to gain momentum, finding its way even into major newspapers. Trade publication *The American Bee Journal* directed its readers to an important reference to bees in a January, 1873, article in the *Chicago Daily Tribune*.[62] Asking whether the winters had grown colder, the author of the "Rural Home" section discussed a recent conversation with a beekeeper. The author explained that "[a]n old pioneer and a bee-hunter, made me a call yesterday, and I asked him if the winters are growing colder." "I can't say that they are," he replied, "and yet the winters are different." The old apiculturist explained that "killing frosts" arrived sooner than they had in the past, but he attributed this to the draining of the sloughs, which had helped moderate the temperature and moisture in the air. He did not seem overly concerned, though, suggesting only that "we need not be discouraged, but look forward with renewed hope for a return of the old time when honey was abundant."[63] The significance of this account is not so much in the account of one beekeeper in one corner of one state; it is rather in the shared engagement of the subject by a trade publication, a major newspaper, and a common citizen. The brief report on climate published in the March, 1858, *Ladies' Repository* was clearly no fluke. The *Chicago Daily Tribune*'s awareness of the

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[61] Ibid., 669.
[62] "Are the Winters Growing Colder," *The American Bee Journal* 8, no. 8 (February 1873): 180.
[63] "The Apiary," *Chicago Daily Tribune* (January 13, 1873).

subject, combined with the beekeeper's apparent lack of surprise at the content of the inquiry, suggest that concern about climatic change had permeated multiple levels of society.

Scholarly consideration of climatic change continued through the 1870s. In an 1877 article for the *Journal of the Royal Agricultural Society*, Charles Whitehead weighed in on the matter as it related to Kentish orchards. Whitehead asserted that there was "strong evidence that the climate was more genial in earlier times, as grapes were largely grown, and ripened out of doors, and wine was regularly made from them." He offered extensive evidence of such cultivation from the Domesday survey and accounts of the reign of Edward II, not once referring to William of Malmesbury's oft-maligned descriptions of a different region. Whitehead emphasized that grape cultivation was affected by temperature, and he suggested that since "grapes do not ripen now in Kent as they did four or five centuries ago, it must be inferred that the climate has undergone a change, that the mean summer temperature has gradually been lowered."[64] Whitehead's interest in the climate, though certainly not unconcerned with the present, pertained primarily to the alterations of past centuries. His conclusions, and the sources he offered in support of them, are evidence that the idea of a clement medieval climate had yet to be put to rest, and that criticisms of William of Malmesbury's accounts had only encouraged more, rather than less, historical inquiry.

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[64] Charles Whitehead, "Fruit-growing in Kent," *The Journal of the Royal Agricultural Society* 13 (1877): 93.

The valuation of the subject of climatic change was surely great in the late nineteenth century, judging by the flow of information between individuals and publications, and between publications of very different natures. One of the more unusual examples of this—more unusual, by far, than that of *The American Bee Journal*—was an account in the journal of the Brotherhood of Locomotive Engineers. In a brief article titled, "Europe Growing Colder," the author explained that a Swedish newspaper had recently published "an interesting article under the heading—"Why is the climate of Europe growing colder?" The original article was primarily concerned with the discovery of fossilized plants and animals, and the evidence they offered of warmer environments in the prehistoric past. The Brotherhood of Locomotive Engineers found this evidence to be important even in the present. Their brief article explained that this "sinking in the temperature, which moved in a southerly direction . . . seems to be going on in our days also."[65]

As several examples from the 1870s—the preceding article included—have demonstrated, there remained a great deal of concern that the climate was deteriorating and that temperatures were declining. Charles Taber recognized that the "climate of Northern Europe has long been accused of growing colder."[66] He offered, though, an argument much in the same vein as those who assumed that the climate was cooling in the direction of a new, great age of ice. Taber suggested that a "gradual change of

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[65] "Europe Growing Colder," *The Monthly Journal: Published by the Brotherhood of Locomotive Engineers* XII, no. 1 (January, 1878): 5.

[66] Charles A. M. Taber, *The Causes which Produce the Great Prevailing Winds and Ocean Currents, and Their Effects on Climate* (Boston: D. Clapp, 1881), 35.

climate . . . is now progressing in the high northern latitudes," one "so comparatively rapid" that "in many northern countries we even find it verified in modern history."[67] Taber explained climatic change in Europe as a function of the interaction between northern wind patterns and the Gulf Stream; when northern winds changed their course, the warm waters of the Gulf were redirected. This explanation helped "account for the exceptional cold winters of Europe spread over so many centuries."[68] "The historical evidences of Greenland and Iceland possessing a mild climate seven centuries ago," Taber explained, "shows that there has been some cold agent acting on those regions since that time."[69] Proof of this was in the late Swedish spring, the feeble British, Flemish, and Breton vines, and the loss of vineyards from "the elevated lands of France where they flourished three hundred years ago."[70] That the climate continued to deteriorate was evidenced by recent crop failures, as well as by the condition of agriculture in Iceland and Ireland. Taber concluded his pamphlet with a firm assertion in favor of the veracity of climatic change: "In fact there appears no lack of historical proof to show that the climate of many northern countries is slowly becoming colder."[71]

Taber was unsatisfied with his elucidation of these topics, however, and published an updated edition of his 1881 investigation a year later. In this better organized edition Taber explained that climatic processes should be understood as global, rather than regional, entities. These "winds and currents" had brought about "the

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[67] Ibid., 4.
[68] Ibid., 34.
[69] Ibid., 35.
[70] Ibid., 36.
[71] Ibid., 54.

wonderful climatic changes which have taken place during long periods of time on different parts of the earth," varying across a spectrum between the "great ice periods" and the "intervening eras of mild weather."[72] Taber succinctly explained his theory of climatic change in the world's northern realms:

> My impression is, that when the conditions are favorable for the warm waters of the tropics to reach the polar seas, the climate of arctic lands will be raised in proportion to the heat carried by such warm waters to their shores. On the other hand, when the conditions are such that the warm tropical currents are forced away from the high latitudes, it will result in a cold climate, because the heat received in such latitudes from other sources would not be sufficient to prevent it.[73]

The only force capable of effecting the movement of such water and warmth, Taber believed, was that of the "great prevailing winds, which are constantly sweeping over the ocean."[74]

Taber remained confident of his earlier assertions of a colder Europe, so much so that he added that "history gives no account of a country situated in high northern latitudes of having possessed a colder climate than it has been subject to during the last century."[75] Taber admitted that records of bitterly cold years might be extant for millennia past, but he suggested that such records would be remarkable for their exceptionality, not for their accordance with a colder mean. Temperatures had been warmer in the not-so-distant past. "Centuries ago," he wrote, "the climate of Scotland

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[72] Charles A. M. Taber, *How the Great Prevailing Winds and Ocean Currents are Produced, and How They Affect the Temperature and Dimensity of Lands and Seas* (Boston: A. Williams & Co., 1882), 3-4.

[73] Ibid., 43-44.

[74] Ibid., 44.

[75] Ibid., 45.

was more favorable for the growth of heavy timber than it now is; tradition and history lead me to this belief, while the remains of ancient forests confirm it."[76] The growth of bogs rather than forests was further proof that "the last four or five centuries" had been notably "inclement."[77]

There is one significant omission in Taber's argument—one rendered particularly notable by the fact that it would have supported his assertions. Taber did not believe that there had been any glacial advancement. Having defended his theory of slow warming from an "ice period" and slow cooling possibly towards another one, Taber admitted that "whatever increase of cold there may have been in the high northern latitudes, there does not appear to be any decided increase in the glaciers of mountain ranges situated in the temperate zone."[78] "The Alpine glaciers, so far as I am informed," he continued, "have shown no general retreat or advance during recent years;" in the valleys one found some "falling back" while others advanced "their fronts down to lower levels."[79] Two possibilities present themselves; either Taber misinterpreted the evidence of glacial advance and retreat and assumed neither was predominant, or he was simply misinformed. This omission is rather surprising as recognition of alpine glacial advance should not have been a revelation. W. G. Heathman, it has already been shown, identified in 1854 the detrimental consequences such advance had exacted upon Swiss villages.

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[76] Ibid., 72.
[77] Ibid., 73.
[78] Ibid., 72-73.
[79] Ibid., 3.

Despite the fact that Taber had found no evidence of Alpine glacial advance, he remained confident that an alteration had indeed taken place. In addition to the evidence he put forth in 1881, Taber offered a unique anecdote in support of his contentions:

> A correspondent of the *Spectator* writes from Northern Russia, where the Volga is locked with ice for six months of the year, that "the people are beginning to show increased resentment at the climate, and that there is reason to believe that the northern government of Russia will be abandoned to the desert. The people silently glide south by scores of thousands every year, till the life of Russia is concentrating in the south."[80]

For Taber, accounts such as these were proof of an era of climatic cooling; they were not, however, evidence that the preceding period was the *warmest* period possible. Taber believed that the truly ancient warm periods of the far north were never to occur again because of the separation of the Indian and North Atlantic Oceans. "The era of high temperature which must have followed the earlier ice periods," he suggested, "did not prevail in the high northern latitudes to any great extent after the ending of the last northern ice period."[81] Despite this limitation, Taber's identification of alternating warm and cool periods, with their anticipated though as-yet-unproven impact on glaciers, bears remarkable resemblance to the "novel" theories of the twentieth century.

Climatic change continued to develop as a subject of interest, gaining by 1882 the attention of Harvard College's Museum of Comparative Zoölogy. On the museum's behalf, J. D. Whitney published a discussion of geological climatic changes which addressed many aspects of the long-running debate about climate. Although Whitney

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[80] Ibid., 74.
[81] Ibid., 82.

discussed periods far beyond the limits of the present narrative, he also gave significant attention to nineteenth-century climatic changes. Such changes were central to his investigation. Whitney stated early in his text that the "recent shrinking of the Alpine glaciers has laid bare large surfaces which but a few years ago were covered with ice."[82] Although he did not believe, as some did, that this recession was the result of a diminution of temperature, he addressed the subject of cooling nonetheless. Whitney suggested that "[b]y far the most important and elaborate publication relating to the question whether there is evidence, not instrumental, of a change of temperature during the historic period in any part of the globe is that of Arago."[83] Whitney explained the significance of Arago's work:

> So far as the present writer is able to make out from a careful perusal of Arago's work, it appears that the evidence collected by him does on the whole point to a deterioration of the climate of the world, in the sense of a refrigeration; and that for certain countries the facts furnished in the volume in question, supplemented in some cases by more recent information from other quarters, do justify us, most decidedly, in drawing the inference that their climate has become colder to a quite appreciable amount.[84]

Despite this seeming agreement, however, Whitney did attempt to separate himself from some of Arago's conclusions. Whitney criticized his rejection of global climatic change, suggesting that Arago came to this conclusion primarily through a misinterpretation of Middle Eastern climate. This required the explanation of European climatic change as a result solely of local circumstances; Arago "falls back on cultivation of the soil and

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[82] J. D. Whitney, *The Climatic Changes of Later Geological Times: A Discussion Based on Observations Made in the Cordilleras of North America* (Cambridge: University Press, 1882), 8.
[83] Ibid., 229.
[84] Ibid., 230.

disforesting of the country as the real agents of the mischief."[85] "The reader will notice," Whitney hoped, "that while removal of the forests is usually considered to be the cause of heat and dryness," Arago made it "responsible for just the opposite effects."[86]

Whitney believed that some degree of climatic change could be ascribed both to Europe and North America, but he also suggested that a recognizable change had occurred in the northern polar region over the course of a few centuries. While anecdotes of easy journeys had been long-criticized as exaggerations, Whitney found them potentially accurate. It seemed to him "not unreasonable to believe that there may be more truth in them than has generally been admitted," because he found himself "strongly impelled to believe that access to the lands lying in that part of the world" had "become less easy than it was some centuries ago."[87] The summation of this evidence could only suggest climatic change:

> After due consideration of the facts here presented it seems not unreasonable to make the assertion that, on the whole, there is evidence, very considerable in amount and importance, to the effect that a decrease of temperature during historic times has manifested itself in various ways besides desiccation; and that if such decrease has not yet become perceptible in instrumental records, it is because the conditions under which observations have been taken are not satisfactory, and the length of time they have been kept up is not sufficient for the demonstration of a change, which, although perhaps called rapid when looked at from the geological point of view, is very slow as compared with the ordinary progress of historical events.[88]

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[85] Ibid., 235.
[86] Ibid.
[87] Ibid., 240.
[88] Ibid., 241.

He concluded that, having "been led directly to the hypothesis of decreased temperature by a long array of facts which seemed to demand the intervention of that agency, our reluctance to accept the indicated deterioration of climate cannot but be lessened."[89]

While Whitney found historical evidence convincing on its own, he admitted that there was as yet insufficient instrument data to support an argument with such evidence. Although he did not believe that he could "furnish positive proof, based on instrumental observations, of a perceptible change of climate in the countries where such records have been kept," he remained optimistic for the success of future generations. Agreeing with Arago, Whitney remarked that "a few centuries of accurate observations will probably throw light on the question."[90] Glaciers, however, remained one of the best indicators of climatic change because of their sensitivity to atmospheric and hydrological variation. Whitney recognized this, suggesting that they "are by no means stable things," being "subject to changes of dimensions" that can "take place with extraordinary rapidity." During the preceding fifty years, he was confident in contending, "all those glaciers throughout the world with which we are sufficiently well acquainted . . . have been more or less rapidly and regularly diminishing in size."[91] He noted with surprise, however, that so little data had been collected on these excellent indicators—especially those in areas with extensive historical records like the Alps.

Whitney believed that recognition of glacial recession in the Alps could be traced to the two decades preceding 1830—the same era that the present analysis has posited as

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[89] Ibid.
[90] Ibid., 257.
[91] Ibid., 326.

transformative because of the disparity between ideas of cooling and warming and the rapidly changing conditions that were actually occurring. Whitney did not explain his reasoning for this assertion, stating only that the "shrinking of the glaciers on the north slope of the Mont Blanc system seems to have been first noticed during the years 1818 to 1828; from that latter date on, it began to be recognized as general."[92] Whitney believed that these glacial changes were directly tied to those of the great ice age, a point which he believed separated his conclusions from those of many geologists. Suggesting a position that would be normative into the 1930s, Whitney asserted:

> It is a fact, however, that most geologists seem to look upon the "Glacial epoch" as something long since gone by and done with, and to consider the climatological condition of the present day as entirely disconnected with that which happened during the "ice age," but this is not the result at which we have arrived in studying the subject: on the contrary, we have found everywhere evidence of continuity and harmony in the action of the causes effecting climatic change, and nothing at all to favor the opposite and popular idea of irregularity and violent alternations of change.[93]

The "disappearance of the ice of the 'Glacial epoch,'" he concluded, was "not something which took place a long time ago, but something which is now going on."[94] How great the diminution of the glaciers had been in comparison to that of previous eras, however, Whitney could not say. It was "not possible," he believed, "to prove that the Swiss glaciers are not shorter now than they have been at any previous time since the period of their greatest extension." Whitney acknowledged the existence of "traditions of the Alps having been once, 'during the Middle Ages,' very much more denuded of snow and ice,"

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[92] Ibid., 328.
[93] Ibid., 333.
[94] Ibid.

but he suggested that "those who have studied the subject most carefully do not put confidence in these stories."[95]

Most early writers seemed to recognize the potential for climatic change to cause some degree of economic disruption and social dislocation, and Whitney was no different. In his discussion of Alpine glacial advances, he noted that "sometimes the advance in certain regions has been so rapid as to excite the greatest alarm among those living in the neighborhood; at other times the recession has attracted an equal amount of attention." Whitney offered as example of this concern an anecdote from the 1690s in which the people of Chamouni requested and received—with success—the assistance of the Bishop of Annecy in halting the advancing glaciers. For Whitney's Alpine contemporaries, however, glacier advancement might have been a (temporarily) welcome sight. The recession of the Alpine glaciers greatly concerned the Swiss because it threatened a lucrative, and apparently growing, tourist industry. This alteration, Whitney explained, was "looked upon as a misfortune, for the money value of the picturesque element in the Alps is now universally recognized by the Swiss."[96]

An encyclopedia article about Iceland offers further indication that the theory of post-medieval climatic change had worked its way throughout learned society. The article asserted that the "climate of Iceland has changed, and seems to be still changing." Although this assertion applied to Iceland throughout its geological history, and was supported by such evidence as ancient forests turned to coal, is made specific reference

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[95] Ibid., 341.
[96] Ibid., 333.

to more recent climatic changes, as well. Agricultural changes were evidence of climatic change in the historical era. "Different sorts of grain," the author contended, "which were extensively cultivated 300 years ago, cannot now be raised at all." Although the author believed that the "winter is not extremely severe," it was "very long."[97] This brief article may have lacked the specificity of many of its contemporaries, but the presence of these assertions in a universal encyclopedia is worthy of notice.

The Alps had held an important position in the discourse of historical climatic change for several decades going back at least as far as 1855, when W. G. Heathman reported on Alpine glacial advance. In fact, with the exception of the rise and decline of English viticulture, no other subject had commanded so much attention. As more of the American West was explored and documented, however, mountain ranges like the Sierra Nevada and the Cascades began to make important contributions to the study of climate. Several scientists attempted to measure climatic change and glacial advance and recession using natural sources in the western ranges, and François Matthes made them the focus of his groundbreaking twentieth-century studies.

Israel Russell's 1886 investigation of Mono Valley, California, is of particular interest for the study of historical climatic change and the idea of the Little Ice Age. Russell believed that the "living glaciers" of the Sierra Nevada were of relatively recent origin. "The present glaciers," he wrote, "are perhaps the shrunken remnants of the ancient ice rivers," but, based on careful analysis of lacustrine evidence, he concluded

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[97] "Iceland," in *Johnson's (Revised) Universal Cyclopædia: A Scientific and Popular Treasury of Useful Knowledge*, vol. 4, ed. Frederick A. P. Barnard and Arnold Guyot (New York: A. J. Johnson & Co., 1886), 180.

that "they have had a fresh beginning in quite recent times." Russell believed that the ancient glaciers had probably disappeared and been replaced. "The present glaciers," he concluded, "are therefore the result of a modern climatic oscillation." Russell would not go so far as to conclude that this oscillation marked the "commencement of a secular period of low mean annual temperature," though, leaving the answer to this question to future investigations.[98] Russell did not view his endorsement of climatic change as a rejection of uniformitarianism. Writing on the perceived, vast difference between climates ancient and modern, Russell concluded:

> In making such a statement, however, it is evident that we are comparing the events of a day with the whole volume of history. Could we look into the future with as much accuracy as we are able to review the past, it would be evident that changes are now in progress that in time will equal the apparent revolutions which occurred during the Quaternary. This, as every one will see, is but a restatement of the uniformitarian belief of geologists.[99]

Change, he believed, was a process internal to the uniformity of nature.

Not all investigations of North American glaciation came to the same conclusion as did Israel Russell. Robert Bell, the Assistant Director of the Geological Survey of Canada, presented a paper in 1889 on Canadian glaciation that suggested a slow climatic transition from the conditions of the great ice age to that of those of the modern era. "It is therefore very improbable," he contended, "that the ice disappeared from all parts of the continent at the same time;" instead there "must have been a gradual and progressive recession northward of the general glacial condition, which may not yet

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[98] Israel C. Russell, "Quaternary History of Mono Valley, California," *Eighth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1886-'87* (Washington, D.C.: Government Printing Office, 1889), 326.

[99] Ibid., 390-91.

have entirely ceased." Even Bell admitted that this long recession had probably not been continual, and went so far as to suggest that a new period of cooling had begun. Bell argued that it was "more probable that we have passed the period of the greatest warmth, and that a colder condition has again begun to creep upon us from the north." He offered no real timeframe for this glacial "creep," but the evidence he cited—the "continued elevation in polar regions, historical facts in Greenland, the southward retreat of the verge of the forests, and other circumstances"—suggest that he was describing a historical period.[100]

By 1892, at the latest, a rudimentary chronology of historical climates had begun to spread within the scientific community. Although these periods were not yet named, the way in which they were used textually—off-hand and by specialists from other fields—suggests some recognition of them as periods. Writing on fossils in the Boston area, Warren Upham made direct reference to a warm medieval period. Upham cited Russell on the glacial recession of the preceding millennium, but he also suggested that there had been a marked cooling at the same time. During this time "the North Atlantic area has been growing colder, gradually excluding the southern mollusks" and "causing the ice-sheet of Greenland to increase again." This same process also gave to Greenland "a much less hospitable climate than during the prosperous period of the Norse colonies, from 900 to 500 years ago."[101] Upham's identification of the centuries between A.D.

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[100] Robert Bell, "Glacial Phenomena in Canada," (paper read before the Geological Society of America, December 26, 1889), in *Bulletin of the Geological Society of America* 1 (April 1890): 307.

[101] Warren Upham, "Recent Fossils near Boston," *The American Journal of Science* 43, no. 255 (1892): 208.

1000 and A.D. 1400 as “the prosperous period,” and his assertion that declining conditions followed this period suggested the beginnings of a date-based climatic chronology.

The nineteenth century was an important era for the development and dissemination of theories of historical climatic change, but it was not a monolithic era. For much of the century, ideas of warming and cooling were maintained alongside each other. The rapid climatic changes that some believed were occurring in the 1820s and 1830s made it difficult to settle upon one theory. Even after evidence of warming had arrived in glacial regions during the 1850s, ideas of uniform cooling continued to find expression. Most evident in this era—certainly more evident than any growing consensus—was the fact that individuals from a greater variety of disciplines began to engage the subject of climatic change. Beekeepers, reverends, travelers, editors, and trade journals paid close attention to supposed environmental alterations, in many cases offering their own perspectives both on methods of prevention and response and on any greater meaning that such change might portend. The idea that records of medieval English viticulture offered evidence of more clement conditions, so controversial in the early 1800s, was much better established by the end of the century. Natural scholars applied a greater variety of documents, now from the continent as well as from England, to the satisfaction of that question. No climatic periods were perfectly defined or dated in the eighteenth century. W. G. Heathman and Warren Upham may have come the closest in their respective suggestions of an Alpine glacial advance after 1600 and a “prosperous” Norse period between 1000 and 1400, but neither dedicated extensive

discussion to the subject. Climatic changes of the nineteenth century changed the debate about climates of the past. It would be left to future scholars to iron out the exact definitions of historical climatic regimes.

CHAPTER V

ELLSWORTH HUNTINGTON, CHARLES RABOT, OTTO PETTERSSON, AND THE SECOND GREAT AGE OF CLIMATIC PERIODIZATION

The early twentieth century witnessed the first investigations by several figures who would revolutionize the way historians, scientists, and the press wrote about climates of the past. This era might also be thought of as a "great age of climatic periodization." The concept of climatic change attracted more scholarly attention and underwent more alteration during this period than during any preceding period. Ellsworth Huntington, Otto Pettersson, Charles Rabot, and François Matthes made the greatest contributions. Geographer Ellsworth Huntington has often been maligned for his assertions and methodology. Nevertheless, he bears more responsibility than any other geographer or scientist for the widespread, modern understanding of climate as a critical, dynamic force in the workings of society. Huntington also did more than any prior natural scholar to popularize the idea of climatic periods through his engagement of multiple scholarly disciplines and his ability to write in a manner accessible to a large audience.

Biographer Geoffrey Martin has suggested that Huntington's influence on the present has been underestimated, when it has been acknowledged at all. Martin believed that, in 1973, scholarship was "moving towards a unitary study of human affairs in which the arbitrary and obstructive barriers between the traditional separate 'disciplines'

[were] being broken down progressively." Huntington, he asserted, was a "pioneer" in this "liberating iconoclastic movement," and as such was subject to uniquely sharp criticism. His significance for the study of climate is demonstrated by the revolutionary nature of his work—particularly that of the first three decades of his career. Martin explained that Huntington "not only looked at human affairs as a unity; he also looked at them in relation to the natural environment in which mankind has made its appearance on this planet."[1] Huntington's investigation of this relationship led him to several important conclusions about climatic change and its impact on human and natural history.

Huntington first developed an interest in climatic change in 1901 after reading James Geikie's *The Great Ice Age and Its Relation to the History of Man* aboard a ship during a return from Turkey to the United States.[2] His first published endorsement of the influence of climate on history came in 1904, as part of a report on his exploration of Turkestan. Huntington expressed his concern about the lack of information regarding climatic change in areas untouched by glaciers. He wrote that the "influence of climate, especially the physiographic results of climatic changes in nonglaciated regions, are so little known that it has seemed necessary to devote some attention to a theoretical examination of these questions."[3] Huntington titled the concluding section of his report

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[1] Geoffrey Martin, *Ellsworth Huntington: His Life and Thought* (Hamden, CT: Archon Books, 1973), ix.

[2] Ibid., 22-26.

[3] Ellsworth Huntington, "The Basin of Eastern Persia and Sistan," in *Explorations in Turkestan: With an Account of The Basin of Eastern Persia and Sistan, Expedition of 1903, under the Direction of Raphael Pumpelly* (Washington, D.C.: Carnegie Institution, 1905), 220.

"Climate and History," the subject he considered to be "the main object of our expedition."[4] He believed that eastern Persia would be particularly useful for analyzing the relationship between the two entities because of its long and dynamic history. Huntington operated within a discipline with boundaries already defined by two diametrically opposed schools. He identified these schools with individuals, but readers of this narrative will recognize them as present throughout early modern history. The first theorized that "the climate of Persia has remained practically unaltered throughout historical time" and that the "decay of the country is due to wars and massacres and the frightful misgovernment which has prevailed century after century." This humanistic, aclimatological theory posited that the establishment of "a strong, just government" would restore the country to its former glory.[5] In opposition to this theory was the school of thought that held that "during the last two thousand years the climate must have changed." While this school acknowledged that "[w]ars and misgovernment have been a fearful curse," it believed that "their influence was not sufficient to account for the location of large towns in places where to-day a caravan can with difficulty find a pool of brackish water." Huntington sought the truth not through identification with either perspective but rather through answers to three specific questions:

> (*a*) Do wars and misgovernment necessarily cause permanent depopulation? (*b*) Are Eastern Persia and its neighbors able to support a much larger population than that which now occupies them? (*c*) Is there any independent evidence that the climate either has or has not changed during historical times?[6]

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[4] Ibid., 302.
[5] Ibid., 308.
[6] Ibid., 309.

Huntington's responses to these questions were specific only to one location. Much like the questions themselves, however, the theoretical framework he developed for interpreting climatic influence is applicable to climatic history in general. To the question of war and misgovernment causing depopulation, Huntington answered in the negative. Comparing the histories of four provinces—Korasan, Azerbaijan, Kirman, and Sistan—Huntington concluded that "[w]ars and misgovernment do not seem to necessarily cause depopulation, nor has that process gone on most rapidly where war has been most prevalent."[7] Huntington had stumbled upon an important lesson of history: populous and fertile land—with the wealth and social comforts they might offer—have the potential to *invite* warfare and misgovernment repeatedly without extinguishing the source of invitation. To the question of the region's potential for supporting a larger population, Huntington offered little discussion, merely suggesting that the frequency of famines in Persia made such capability unlikely—an assertion disproven in the intervening century. Huntington answered the third question he posed, that of the existence of "independent evidence" of climatic change, through a comparison of legends and physiography. Admitting that the "written accounts which afford evidence as to the ancient climate are scattered in numerous inaccessible volumes and have not been investigated," Huntington attempted to utilize evidence from legends.[8] He

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[7] Ibid., 310.
[8] Ibid., 311.

acknowledged that they were "proverbially untrustworthy," but he also believed that there was "usually a solid kernel of truth in their center."[9]

The eastern province of Sistan, in particular, yielded convincing results on the utility of such legendary evidence. The "agreement between the traditional and the physiographic history of Sistan," he wrote, "is so close as to amount almost to identity."[10] "At Sistan," he continued, "history and physiography appear to join hands."[11] Huntington's contribution to geography and history is often minimized through the application of the epithet "determinist," as in, "environmental determinist." As his responses to these three questions demonstrate, however, such disparaging criticism is misplaced and likely representative of the removal of his quotations from their context. From his earliest and most elementary forays in the subject of the climatic influence, Huntington was careful to weigh multiple causative factors in each situation and to utilize the tool of comparison—an attempt to *avoid* the determinism which defined the state of the debate at the time.

Huntington understood his interdisciplinary approach to history and climate as an attempt to revolutionize scholarship. His personal notes attest to this realization. While developing a theory of "a change of climate within historic time," he had already begun to "philosophize" on the impact this discovery would have on the study of history.[12] Huntington hoped to dedicate at least a decade to the completion of a book illuminating

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[9] Ibid., 312.
[10] Ibid., 314.
[11] Ibid., 315.
[12] Martin, *Ellsworth Huntington*, 45.

"the true relation between history and geography" in Asia. He wrote unequivocally in his notes:

> In that book I want to so bring out the relation of man and his history to the physiographic and climatic environment and to changes that have taken place in that environment that every future historian shall have to take into account the ideas there laid down. That is the sum of my scientific ambition.[13]

In 1905 Huntington left the United States for Asia, commencing a seventeen-month expedition that would serve as the basis for one of his most celebrated—and criticized—books, *The Pulse of Asia*. It was "perhaps the most important expedition Huntington undertook."[14] Huntington travelled across the Himalayan Mountains and into Inner Asia, documenting as he did evidence of climatic change and desiccation. The experience of the Asian expedition convinced him that the "anthropological sciences" were "bound together by the unifying principle of evolution." He contended that the disciplines of "[g]eography, anthropology, history, and sociology" formed "an anthropological group possessing a unity as great as that of the biological sciences."[15] Huntington conceived of a particularly intimate relationship between the forces of geography and history:

> Climate, the relation of land and sea, the presence of mountains, the location of trade routes, and the suitability of a region for agriculture, mining, or manufacturing are all potent factors in determining sociological conditions. The dependence of history upon geography is equally great. In recent years there has arisen the so-called "bread and butter school" of historians, who hold that the deepest cause of historical events is the necessity of mankind to subsist. The ambition of kings, the hatred of race for race, the antagonisms of religion, may

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[13] Ellsworth Huntington, notes, Ellsworth Huntington Collection, Yale University Library, quoted in Martin, *Ellsworth Huntington*, 45.

[14] Martin, *Ellsworth Huntington*, 47.

[15] Ellsworth Huntington, *The Pulse of Asia* (Boston: Houghton, Mifflin, and Company, 1907), 1.

> agitate the surface and cause the waves which seem to us so portentous; but far down below all these there is the unending struggle for bread. It is this primarily which makes men work.[16]

Geography, as such, was "clearly the basis of history, for the productivity of a country depends upon geographic facts, especially upon climate."[17]

Huntington, however, never implied that the characteristics of mankind were entirely defined by the environment. Such "physical processes," he wrote, could not "explain life, or mind, or ideas," which remained as yet impossible to define or even fully understand.[18] There instead existed a complex relationship between such forces, which Huntington explained in an analogy as colorful as it was instructive:

> Now, we begin to see that man's course has been guided by his physical surroundings, just as a railroad winds here and there at the command of river, hill, or lake. To carry the analogy farther, the living mind of man, with its idea, its love, and its pain, is the motive force to which is due the progress of human institutions; and history is the track along which man has advanced. . . . The track, too, has been scrutinized minutely by historians; and we know its curves and grades, both up and down. One thing alone has been neglected: we have not looked at the country through which we have passed. To-day we are beginning to study our surroundings, and to see that we have reached our present position because of certain geographic facts. Historians have been slow to accept this view. When they found a piece of downgrade in the track, they looked at the cars and the engine to find the cause.[19]

Huntington believed that an understanding of climatic change could help illuminate the great movements of history, its turns and alterations of grade. "The relapse of Europe in the Dark Ages," he suggested, "was due apparently to a rapid change of climate in Asia

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[16] Ibid., 3.
[17] Ibid.
[18] Ibid., 4.
[19] Ibid., 3-5.

and probably all over the world, —a change which caused vast areas which were habitable at the time of Christ to become uninhabitable a few centuries later."[20]

Although Huntington's analytical eye often focused on hydrological climatic crises—desiccation, he also addressed alterations of temperature. Analyses of both were widely applicable, though, because each sought to explain the avenues of response available to marginal societies amidst deteriorating conditions. Huntington's discussion of the Asian climate, however, did not reach the same conclusions as his counterparts had in regard to Europe and the Americas. While he recognized that climate had changed in the preceding millennia, he suggested that, during the "mediæval epoch, the climate again became slightly cooler and moister."[21] Beyond outlining a few unusual winters in the eleventh and twelfth centuries, though, he gave little discussion to this medieval cooling, writing of it that "there is little to be said."[22] Building upon the suggestions of such historians as Edward Gibbon, Huntington recognized that Europe's temperatures, too, had changed. Furthermore, the medieval cooling and moistening that he ascribed to Asia were directly related to Europe's comfortable medieval circumstances. "When the progress of desiccation was stayed in Asia," he wrote, "and the desert lands began to grow slightly more habitable, there was no further impulse impelling migration, and Europe was freed from further invasion." "At last," he continued, "at the beginning of the Middle Ages, she was free to develop in response to

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[20] Ibid., 5.
[21] Ibid., 44.
[22] Ibid., 46.

the favorable climatic conditions which had come upon her."[23] This relationship between the conditions of one area and the historical circumstances of another was the central tenet of Huntington's theory of pulsatory, or cyclical, climatic changes. "With every throb of the climatic pulse which we have felt in Central Asia," he asserted, "the centre of civilization has moved this way or that." "Each throb," he concluded, "has sent pain and decay to the land whose day was done, life and vigor to those whose day was yet to be."[24]

Not long after the publication of *The Pulse of Asia*, Huntington penned a brief article for the *Monthly Weather Review* on the climate of the historic past. In this article he explained with more specificity his perspective of recent climatic changes. Huntington made it clear that there existed a "large gap" between the "climatic changes of the glacial period and the temporary changes which now occur within the observation of a single generation." He was also well aware of the fact that the climatic change had been contentiously debated in the preceding decades:

> Meteorologists have not as a rule accepted the hypothesis of important historic changes of climate. They have held that while small changes may have occurred, the general course of climate has been uniform and that a slight fluctuation in one direction during a period of a few years has always been compensated by a slight fluctuation in the other direction at a succeeding time. In proof of this they point to the unquestioned fact that the meteorological records of the past two hundred years or less either indicate no permanent change whatever or one so small that it is less than the uncertainty of the numerical averages that describe the climate.[25]

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[23] Ibid., 384.
[24] Ibid., 385.
[25] Ellsworth Huntington, "The Climate of the Historic Past," *Monthly Weather Review* 36, no. 11 (November 1908): 359.

Huntington, however, was apparently unaware that European climatic change had been a subject of some consideration for several centuries. "The possibility of changes of climate in Europe," he contended, "has not been much discust," with the exception, of course, of the recognition already credited to Gibbon. Nevertheless, Huntington suggested that it "would be rash to conclude that climate has not changed even in Europe." Identifying a critical error in the conclusions of nineteenth-century and early-twentieth century skeptics, Huntington theorized that several centuries of relative climatic stability cannot be assumed as definitive proof that the climate of the antecedent centuries was also the same:

> In that continent a moderate change in either direction would produce few results which could be recognized after a lapse of hundreds of years except in countries such as Spain and Greece which are at present suffering from aridity, or in countries such as northern Russia which would be greatly influenced by a decrease in the length of summer.[26]

In 1913 Huntington addressed historians directly on the relationship between climate and history. This was something he had wanted to do for some time, as evidenced by his ambition to complete a book on climate that no historian could ignore. In a 1913 article for the *American Historical Review*, Huntington explained that it was "not by accident that the most universal subject of conversation is the weather," because of "the fact among the phenomena of nature none affect mankind so directly and vitally as those which pertain to climate." Huntington traced the recognition of this importance to Ancient Greece and, in particular, Aristotle, who had explained the legendary flood of

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[26] Ibid., 364.

Deukalion as part of a cycle of colder and wetter conditions that, over time, recede and return. "In other words," Huntington wrote, "he announce[d] the theory of pulsatory changes of climate."[27] Huntington elaborated:

> For two thousand years that theory lay in abeyance. Many people discussed the possibility of a gradual drying up of the earth, a gradual cooling off, or a gradual increase in warmth, but all the discussions were based on the idea of slow and comparatively regular changes. It was left to the present writer to propose the theory of pulsatory changes once more, quite unconscious that in so doing he was following in the steps of the Greeks.[28]

Huntington also appealed to the self-perception of historians by attempting to separate them into at least two camps: traditional and modern. The "modern historian," he explained, "realizes the importance of physical factors, especially of climate, in influencing some of the great facts of history."[29]

Despite this "modern" recognition of climatic factors, Huntington was not satisfied with historians' understanding of their workings and significance. He contended that, while historians might admit a relationship between climate and history, they do "not usually admit more than a slow and general effect as opposed to the rapid and marked effects which the adoption of the theory of pulsatory changes would naturally demand."[30] Huntington singled out A. T. Olmstead's work on Egypt as an example of this because Olmstead had posited that the influence of climate was most

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[27] Ellsworth Huntington, "Changes of Climate and History," *American Historical Review* 18, no. 2 (January 1913): 213.
[28] Ibid., 213-14.
[29] Ibid., 214.
[30] Ibid.

apparent in a country's long-time occupants.[31] Olmstead believed that comparatively recent transplants to Egypt were not affected by its climate because they had not lived there long enough. Huntington expanded the question one step further into the past, asking why such migrations might occur in the first place. "The geographer who believes in pulsatory changes of climate," he contended, "can scarcely avoid the conclusion that great movements of peoples have been induced by such changes, and that these movements have given rise to periods of invasion and anarchy." Alternately, when such "push" factors have been removed by the rise of more clement conditions, "prosperity and progress have been the rule." Huntington *again* reiterated that he did not believe that climate was humanity's only determinant. "This by no means implies," he asserted, "that all invasions and all prosperity are supposed to be due to climatic causes, but merely that climate has been one of the important factors in producing such results."[32] Huntington could not have been any more direct in his rejection of environmental determinism, yet few of his critics, then or now, have quoted his numerous rejections of monocausality.

Huntington also responded to A. T. Olmstead's 1912 rejection of pulsatory climatic change. Olmstead believed that "the theory of a more immediate influence on the details of history seems to be bound up with the theory of cyclic climate changes and we have seen that the facts of history tend to disprove this."[33] Huntington asked two

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[31] Ibid.; A. T. Olmstead, "Climate and History," *Journal of Geography* 10 (1912): 163-68.
[32] Huntington, "Changes of Climate and History," 215.
[33] Ibid.; Huntington was quoting from Olmstead, "Climate and History," 163-68.

questions in response to Olmstead's rejection, thus slicing to the core of the long-running debate:

> In the first place, was the climate of the past, let us say at the time of Christ, different from that of the present? In the second place, assuming that there has been a change, did it take place gradually or was it characterized by pulsations whereby certain periods were exceptionally dry while others were moist?[34]

Huntington applied physiographic, archaeological, botanical, and historical evidence to the satisfaction of these two questions—the detailed reports that went into the construction of *The Pulse of Asia* are evidence of this four-part approach. He acknowledged that evidence broadly supportive of climatic change was far easier to find than that supportive of climatic fluctuations, but he also believed that he had found a new form of evidence that supported the pulsatory theory. The evidence he found seemed "to indicate that pulsations of climate lasting through periods having a length of centuries have actually taken place."[35]

This new periodization was in direct opposition to the conclusions of Olmstead. Huntington clearly recognized this fact when he pointedly stated that "[t]he question cannot be settled offhand by a reference to 'the facts of history,'" a reference to Olmstead's out-of-hand dismissal of pulsatory change. Huntington's explanation for his reasoning behind this is illustrative of his perspective of the relationship between the two fields:

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[34] Huntington, "Changes of Climate and History," 215-216. The absence of temperature from the argument should not be construed as a dismissal of pulsatory changes in temperature. Huntington more frequently discussed hydrological changes, it is true, but his books and articles contain multiple references to temperature changes as well, often in concert with hydrological changes.

[35] Ibid., 216.

> Long research in the realms of physiography, climatology, archaeology, and, as I shall shortly point out, botany, can alone determine it. In other words the problem is primarily geographical, in the modern sense of that term, and the final decision of geographers must be accepted by historians. When it comes to the study of the effect of any possible climatic changes upon the course of history, however, the case is reversed; the geographer may offer suggestions, but the final decision rests with the historians.[36]

The new form of evidence that Huntington identified for utilization by historians and geographers in formulating climatic arguments was that of measurements of the annual rings of trees. Having seen this method explained by A. E. Douglass in a 1909 article, Huntington tried his own hand at the science, measuring in 1911 and 1912 the rings of more than 400 California Sequoias "which, fortunately for the purposes of historical research, had been cut in order to make fence posts and shingles."[37] The graph which Huntington developed from this data suggested a variable climate. After comparing this with a graph for Asia of a similar time-scale but completely different evidentiary basis, Huntington felt comfortable in suggesting that there seemed to be a global dimension to climatic cycles. This evidence, when combined and compared with archaeological, historical, and physiographical evidence led Huntington to three conclusions: the climate has changed; these changes have occurred with a centurial periodicity; changes in the eastern and western hemispheres have been largely "synchronous."[38] Huntington believed that the evidence he presented, when combined with ideas about how the climate might interact with the economic, social, and political systems of a country, was enough to defend his emphasis on pulsatory climatic changes.

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[36] Ibid., 217.
[37] Ibid., 219.
[38] Ibid., 221.

The "dates and degree of changes," he believed, "may be modified, but the general conclusion does not seem likely to be upset."[39]

In the midst of Huntington's revolutionary study of pulsatory climatic changes, two other scholars—Otto Pettersson of Sweden and Charles Rabot of France—made important contributions to climate theory. Pettersson was a prominent chemist, physicist, and oceanographer whose study of climatic variation was recognized by scholars into the second half of the twentieth century.[40] One of his most important publications was "Climatic variations in historic and prehistoric time," an article quite hard to find now but immensely important to the development of ideas of climatic change and historical climatic regimes. The essay's opening statement leaves no doubt that Pettersson recognized a relationship between history and climate and granted it great significance:

> In the last centuries of the middle ages a series of political and economic catastrophes occurred all over the then-known world. They synchronise with occurrences of a startling and unusual kind in the kingdom of Nature. The casts of Iceland and Greenland became blocked by Polar ice. Frequent volcanic eruptions occurred in Iceland and the surrounding seas. Violent storm-floods devastated the coast of the North Sea and Baltic. In certain cold winters Öresund and the Baltic were frozen over and the lucrative Hanseatic herring fishery of the early middle ages which had been carried on in the Baltic and Öresund ceased altogether. All these events are recorded in ancient chronicles which also depict the social and economic state of the communities, which were greatly influenced

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[39] Ibid., 232.

[40] For an example of Pettersson's impact, see Rachel Carson, *The Sea Around Us* (New York: Oxford University Press, 1951), 183. Carson discussed Pettersson at length, and she believed his theories might help shed light on the cause of the globe's warming: "Now in our own lifetime we are witnessing a startling alteration of climate, and it is intriguing to apply Otto Pettersson's ideas as a possible explanation. It is now established beyond question that a definite change in the arctic climate set in about 1900, that it became astonishingly marked about 1930, and that it is now spreading into sub-arctic and temperate regions. The frigid top of the world is very clearly warming up."

> by these violent climatic variations and their consequences: famine and disease.[41]

Although Pettersson's argument was not unlike those forwarded by other natural scholars in the eighteenth and nineteenth century, none had put it so succinctly while still incorporating natural, social, and economic forces. Pettersson said more about natural history in this paragraph than many writers had managed in entire articles and books.

Pettersson understood his theory of late-medieval crisis, grounded in documentary evidence, to be part of a new interpretation of the past. "Till quite recently," he wrote, "the opinion has prevailed among meteorologists and geographers that the old records are unreliable and exaggerated and that no real variation in the climate has occurred in historic time." Criticism of climatic change theories, evident in the response to the groundbreaking work of Henry Robertson and his contemporaries, remained prevalent, but Pettersson recognized a new approach was on the rise. "Of late," he noted, "dissenting opinions have been advanced in various countries, in Sweden by Ekholm and Sernander, in Germany by Brückner and in America by E. Huntington."[42] This reference to Huntington only reinforces the assertion that his work had an important global impact on the study of past climates.

Following brief discussions of polar ice and of cosmic influences on the climate, Pettersson turned to his primary focus: the climatic circumstances of northern Europe in medieval and late-medieval times. He found evidence of climatic change in the Norse

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[41] Otto Pettersson, "Climatic Variations in Historic and Prehistoric Time," *Svenska Hydrografisk-Biologiska Kommissionen Skrifter*; Häft 5 (1914): 1.

[42] Ibid.

Sagas and delineated three key points: that "the Sagas proper from the 9th to the close of the 12th century never mention that the Norsemen were hindered by ice in the their journeys to Österbygden [in Greenland] while still adhering to the old navigation-route," that of "the 13th century we are told that those who sail for Greenland encounter much ice in the sea," and that "150 years later in the time of Ivar Bårdsson, or at the end of the 14th century, the old sailing-route was abandoned and the ships took a southwestern course to avoid the ice."[43] Pettersson posited that the late-medieval centuries which saw an increase of ice in the North Atlantic also saw an increase in the severity of winters in the Baltic region. He summarized the available evidence:

> That there was a period 6-7 centuries ago when the Baltic, the Sounds, and the Cattegat were frozen over and covered by a solid sheet of ice which could be frequented by pedestrians and carriages in certain winters. This happened most frequently in the 13th, 14th, and 15th centuries but ceased in the 16th century. For the last 250 years the Baltic has not been frozen over.[44]

Pettersson believed that these alterations were "*hydrographic*" rather than "*meteorologic*," but he acknowledged that they could have had an impact on the climate, apparently more narrowly defined, as well.

Pettersson's theory of climatic variation was based upon rather long-term natural cycles. These 1800-year cycles do not allow for the recognition of climatic periods consisting of only two or three hundred years; as such the idea of a Little Ice Age is not apparent in his formulation. The only such period he recognized was that of the maxima of "tide-generating" forces: the thirteenth, fourteenth, and fifteenth centuries.

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[43] Ibid., 9-10.
[44] Ibid., 17.

Pettersson, in fact, believed that the conditions of the Middle Ages were likely *worse* than those of antecedent centuries, but it should be remembered that the centuries he defined as inclement were actually part of the extreme Late Middle Ages. Pettersson's focus on the conditions of these centuries, however, did not greatly undermine the theory of an early modern period of cooler conditions. Rather than serve as a counter to such ideas, Pettersson's formulation actually allows for the recognition of an earlier such period, one which might be called a Medieval Ice Age. Most importantly, however, Pettersson's investigation helped cement in the historical narrative the idea of historical climatic regimes. In his conclusion, Pettersson noted, "It is a recognized fact that after the glacial period great variations of climate have occurred."[45] Pettersson was as much a catalyst for this recognition as he was its observer and historian.

Charles Rabot's important contribution is found in his 1915 report for *La Géographie* on the state of glacial history. The research and conclusions which he recounted demonstrated an understanding that the Alpine climate had undergone a significant change at the end of the sixteenth century. "L'histoire des variations glaciaires dans les Alpes," he wrote, "si importante pour la connaissance des oscillations climatiques, vient de marquer un progrès considérable." Rabot lauded in particular MM. P. Mougin and G. Letonnelier, whose investigations in the archives of Chamonix had uncovered records of glacial changes on Mont Blanc between the end of the sixteenth century and the middle of the eighteenth century. The end of the sixteenth century

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[45] Ibid., 26.

witnessed a marked change from the conditions which preceded it. "Dans les dernières années du XVI^{e} siècle ou au début du XVII^{e}," Rabot contended, "une crue formidable se produit, entraînant la destruction partielle de plusieurs hameaux voisins des glaciers."[46] Within about a decade, this initial movement of the glaciers was followed by a second, forceful thrust, one Rabot described as "non moins calamiteuse." Three decades later, yet another "crue des glaciers" occurred, one "aussi destructrice que les précédentes."[47] This period of glacial expansion was followed by "une accalmie pendant cent vingt-cinq ans environ," during which glaciers generally receded and advanced only rarely and temporarily.[48] This period lasted from about 1645 to 1770, but it was followed by yet another period of glacial expansion which reached its apogee sometime between 1818 and 1825. The next three decades were likened to the "accalmie" of the eighteenth century, but they were followed by a final advance between 1850 and 1855.

Following this brief advance, the conditions and the glaciers retreated. "Ce dernier événement," Rabot asserted, "marque un tournant dans l'histoire des vicissitudes glacières à Chamonix."[49] He did not, however, believe the evidence he had presented was limited to the French glaciers from which his evidence had been taken. Information from other Alpine glaciers suggested to Rabot that the end of the sixteenth century commenced a period of glacial advancement throughout the Alps. Although this period included several eras of stagnation and recession, Rabot's identification of the last two

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[46] Charles Rabot, "Récents travaux glaciaires dans les Alpes françaises," *La Géographie* 30 (1914-15): 257.
[47] Ibid., 258.
[48] Ibid., 259.
[49] Ibid.

decades of the sixteenth century and the year 1855 and critical historical junctures suggest that he understood the intervening years to have comprised a distinct period—a period that would, within a few decades, gain the title, the "Little Ice Age."

Ellsworth Huntington returned to the subject of the climate in 1915 with the publication of a book dedicated to its impact on civilization. Initially Huntington had hoped to write on civilization in general, discussing all the geographic and historical factors which have shaped it. A friend recommended to him that he focus on one aspect—climate, and he did. "This book sets aside the other factors, except incidentally," Huntington explained, "and confines itself to climate," a confinement that he readily admitted was "both its strength and weakness."[50] "In writing this book," he continued, "I have growingly felt the wisdom . . . of concentration upon a single point, even at the expense of seeming to take a one-sided view."[51] Much of the book is focused on the day-to-day impact of atmospheric conditions on intelligence, culture, capability, and aptitude for work. Racial and cultural stereotypes make up a significant part of the chapters on these subjects, as do concepts of human and climatic energy.

Huntington believed that climate was an important element in the distribution of civilization. That the centers of civilization had moved over the course of two millennia was not an indictment of climatic influence, as scholars as early as David Hume had theorized; it was instead evidence of climatic change. Huntington believed that the "subject of climatic changes in historical times" had been "warmly debated for many

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[50] Ellsworth Huntington, *Civilization and Climate* (New Haven: Yale University Press, 1915), v.
[51] Ibid., v-vi.

years," and had followed a progression similar to that of other geological debates. "It seems to be going through stages like those through which the great controversy as to geological changes of climate has passed," he mused.[52] Huntington believed that the understanding of geological-scale climatic change had progressed through stages that originally assumed uniformity, then continuous cooling, before "almost universally" recognizing pulsatory changes between glacial and interglacial periods.[53] In much the same way, he contended, Man's understanding of the climate succeeding the last ice-age had undergone revision. Huntington elaborated:

> As the moraines and other remains of the last ice-age were studied more carefully, it became evident that the latest melting of the ice sheet did not take place steadily. At least three times the climate ceased to become milder and either remained nearly uniform for a while, or else reverted somewhat toward the conditions which induce glaciation. These post-glacial "stages" are constantly becoming more and more clearly defined.[54]

These stages, Huntington believed, were evidence that "after the main pulsations of the glacial epoch had passed away, there was a series of minor pulsations of the same kind, but less severe."[55]

Huntington looked beyond glacial movements for evidence of shorter-term, historical climatic changes. Lacustrine evidence from ancient bodies of water—Palestine's Dead Sea and California's Owens Lake—showed frequent alteration of water levels at elevations above the level of the water-table. "These many movements up and down," Huntington wrote, "indicate climatic changes like those of the glacial period

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[52] Ibid., 222.
[53] Ibid., 223.
[54] Ibid., 224.
[55] Ibid.

except that they are much smaller."[56] This evidence suggested very recent changes, some "probably only a few hundred years old, and certainly not more than a few thousand." When combined with evidence of glacial advancement and recession, it convinced Huntington that "from the earliest geological times down almost to the present day, change rather than uniformity has been the rule."[57]

Huntington acknowledged—then largely dismissed—the two dominant hypotheses pertaining to historical climatic change, the theories "of deforestation and of progressive desiccation."[58] These two hypotheses held opposing viewpoints. The former assumed that the climate could only be altered by surface changes, often because of human activity; the latter assumed that it changed in only one direction. Huntington organized the evidence collected from various sources by date and then attempted to divide the historical age into separate eras determined by their aridity. He identified about eight periods in Asia: moisture in the fifth century B.C., aridity in the third century B.C., "favorable" conditions "at the time of Christ," and the "worst conditions" of historic times around 650 A.D. This inclement era was followed by "an improvement . . . which culminated about 1000 A.D.," another "bad time . . . in the thirteenth century," a "rapid recovery . . . which did not last long enough to be of great value," and the present era, with its "tendency . . . toward aridity."[59] While this timeline was drawn from Asian

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[56] Ibid., 224-25.
[57] Ibid., 225.
[58] Ibid.
[59] Ibid., 227.

evidence, Huntington reiterated his prior assertion that climatic conditions in the western United States matched it quite well.

Analyzing information from California's trees, Huntington posited that a period of glacial advancement probably coincided with a period of greater wetness between 1300 and 1350. This, he believed, was an event of a global rather than continental scale. Lakes rose in the Americas; Holland and Lincolnshire saw beaches overrun and land turned to marsh; European rivers froze "to an unheard-of degree"; frozen stretches of the Baltic Sea were traversable on foot; storms ruined English grain; the Caspian Sea and the lake of Lop Nor rose "with great rapidity."[60] "Such conditions," Huntington concluded, "if intensified, and prolonged, would probably cause the accumulations of enormous glaciers." At Owens Lake, the water-level declined after 1350, reaching a minimum around 1500 A.D. Over the next couple of centuries, however, it increased to form "the highest strand of the latest series."[61] Nearby lakes corroborated the evidence offered by Owens Lake of multiple climatic regimes—regimes which, again, bear some resemblance to the modern definitions of climatic optimums and little ice ages.

Huntington's suggestions about the rise, decline, and movement of civilizations remained a subject of debate and criticism for years to come. In 1926 W. D. Wallis weighed in on the relationship between environment and culture, asserting that the climate's influence could not be measured in ignorance of the cultural milieu in which it operated. "Nature may give the blessing," Wallis explained, "but it is not really a

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[60] Ibid., 236-37.
[61] Ibid., 237.

blessing until man accepts it and learns to utilize it." Those of the philosophical persuasion of Montesquieu and Huntington, he believed, had ascribed too great an influence to the climate. "In explaining everything," Wallis pithily noted, "the environment explains nothing."[62]

Wallis' real opposition to climatic influence, however, appears to have been the result of a quiet dismissal of historical climatic change. Wallis explained that it was a fact that "in some parts of the world the climate has remained constant throughout thousands of years, whereas the civilization in that area has undergone manifold change." He elaborated: "Whether we speak of the valleys of the Nile, the Euphrates and Tigris, the Rhine, or the Po, contrasts in successive civilizations stand out against a background of a same geographical environment." The examples Huntington offered from Palestine and Italy failed to convince Wallis of a significant climatic influence—again, it appears—because of an *a priori* dismissal of significant climatic change. "Huntington does not save the day," he explained, "by pointing to a change in climatic conditions in Palestine and Italy"; these climatic changes had been "trivial compared to the momentous changes in civilization which those lands have witnessed."[63] Ultimately, Wallis argued in opposition to any theory of geographical determinism; "physical environment is the lever as well as the fulcrum, but its leverage is determined by the civilization."[64] Huntington, however, was no geographical determinist; and Wallis'

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[62] W. D. Wallis, "Geographical Environment and Culture," *Social Forces* 4, no. 4 (June 1926): 703.

[63] Ibid.

[64] Ibid., 708.

assertions, when not appealing to philosophical tropes or humanistic exhortations, were predicated on a dismissal of climatic influence and change. That humanity often rises above its conditions, Huntington would *never* dispute; that humanity cannot rise above some conditions—advancing glaciers, flooded crops, and depleted aquifers, Wallis apparently could not accept.

Although Wallis remained unconvinced of the importance of climatic variability, he struggled against a rising tide. For centuries an increasing number of scientists, historians, and geographers had come to recognize that the climate had changed—and not just in a single direction. The 1930s saw the addition of several crucial studies to the body of work on historical climatic change. Some received little recognition for several years; others made an immediate and lasting impact on history and geography. In many cases, the historiography of climatic regimes begins with 1939. What should be apparent by now, however, is that the contributions of this decade—great though they are—cannot be understood in a vacuum, apart from those of the preceding two-and-a-half centuries.

In 1934 George Hanson, Fellow of the Royal Society of Canada, came to an important realization: Canadian glaciers had not retreated uniformly from the previous ice-age and had instead fluctuated, disappeared, and reappeared in successive stages. He made this discovery during an investigation of the Bear River Delta in northwestern British Columbia. Hanson sought the answer to one question about the coastal glaciers of this province:

> Do these represent the remnants of the Cordilleran ice sheet which during the Pleistocene covered most of British Columbia, or did they have their beginning

> and grow to their present size in Recent times and, if the latter is the correct explanation, how old are they?[65]

Based upon measurements of glacial stream-flow and deltaic deposits from the Bear River, Hanson determined "that the Pleistocene ice practically disappeared prior to uplift" ten millennia before present. "Since the present rate of growth of the delta suggests that it was built in less than 3600 years," he explained, "it is obvious that if any glaciers persisted since the Pleistocene they must have been very small and inactive for a period of several thousand years."[66]

At the close of the Pleistocene, the fjords of the Bear River Delta underwent a series of geographical and climatic alterations. The Pleistocene ice receded and the land rose; then the climate began to cool again. The glacial conditions of the region at the time of Hanson's study were of geologically recent origin—four or five thousand years. Although this period was, on the whole, cooler than that in which the Pleistocene glaciers had retreated, its conditions were not monolithic. "The only evidence available in the area to show variations in climate in Recent time," he asserted, "is . . . that the glaciers comparatively recently, perhaps 100 or 500 years ago, were larger than at present, indicating a colder interval."[67] Hanson's suggestion of a "colder interval" encompassing some part of the mid-fifteenth through mid-nineteenth centuries would not garner great attention for a few years, but it is clear that Hanson recognized—

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[65] George Hanson, "The Bear River Delta, British Columbia, and its Significance Regarding Pleistocene and Recent Glaciation," *Transactions of the Royal Society of Canada* 28, Section IV (1934): 179.

[66] Ibid., 182.

[67] Ibid., 183.

scientifically, if not historically—that a largely unknown period of glaciation had occurred during historic times.

By the end of the 1930s, geologists had begun to develop an idea of a climatic period comprising several millennia. Ellsworth Huntington had alluded to such a period decades earlier in his discussion of western American lakes. Other geologists had proposed chronologies for the period following the great ice age. Ernst Antevs, a research associate with the Carnegie Institution, referenced such periodizations in a 1938 article on climatic variations in the American southwest. A new, "Postpluvial" era had commenced when "temperatures rose and rainfall decreased" approximately 10,000 years before the present; this period was divided into three parts, the Early, Middle, and Late Postpluvials.[68] Antevs focused upon the Late Postpluvial, which began around 2000 B.C. As suggested by its name, geologists believed the Postpluvial era to be notable for its degree of moisture. Based upon his analysis of several lakes, including the aforementioned Owens Lake, Antevs asserted that a "change from dry to moist conditions occurred about 2,000 B.C."[69] Owens Lake was, of course, the same lake Huntington had identified decades earlier as evidence that major climatic alterations were "probably only a few hundred years old, and certainly not more than a few thousand."[70] Antevs even referenced some of Huntington's concepts to support his assertions. Although seemingly an extension—both in chronology and subject matter—

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[68] Ernst Antevs, "Postpluvial Climatic Variations in the Southwest," *Bulletin of the American Meteorological Society* 19 (May 1938): 190.

[69] Ibid., 191.

[70] Huntington, *Civilization and Climate*, 225.

beyond the range of the present research, over the next decade the idea of this unique Late Postpluvial period would become increasingly important to the history of climatic periodization.

The first four decades of the twentieth century changed the nature of climatic history. Otto Pettersson provided voluminous evidence of cyclical climatic change. Charles Rabot offered the first definition, explained in detail and bracketed by dates, of the period that would come to be known as the Little Ice Age. Ellsworth Huntington took a subject rarely discussed at length and dedicated numerous articles and even an entire volume to it. His impact on the study of climate and, consequently, the study of history cannot be understated. It may be criticized, as it often has been, but such criticism ought to be dismissed. As his biographer, student, and friend Geoffrey Martin asserted, in a quotation attributed to Chauncy D. Harris, "[m]ost people who criticize him have never read his work."[71]

Ellsworth Huntington wrote to provoke discussion, to prompt investigation, and to generally move forward the body of science. Such suggestion and provocation, Martin asserted, was part of Huntington's "concept of the scientific method."[72] His attention to the subject of climate fits well to these general definitions. Huntington's expression of climatic ideas through popular geography textbooks and narratives of daring adventures in unknown lands did much to popularize the subject of climate. He will remain a contentious figure in geographical history; his advocacy of eugenic

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[71] Martin, *Ellsworth Huntington*, xvi.
[72] Ibid.

principles in the second half of his career ensures this. The value of Huntington's contribution to the study of history, however, should not be in doubt. No other writer published so much on the subject, particularly in formats accessible to the public; and no other writer had so much influence on the way historians, geographers, and laymen thought about climate, even if he did not always influence their actual conclusions. Martin probably expressed Huntington's value best when he asserted that "[p]robably no twentieth-century American geographer stood forward so prominently as the representative of the aggregate knowledge of his age."[73] The fact that theories of climatic periodizations were advanced so rapidly in the twentieth century was due, in large part, to Huntington's advocacy of the theory of pulsatory changes of climate.

[73] Ibid., 253.

CHAPTER VI

FRANÇOIS MATTHES AND THE LITTLE ICE AGE

Geologist François Matthes has been credited with—when not blamed for—the first conceptualization of a "little ice age." As terminology goes, that may well be the case. As ideas go, however, Matthes was actually engaging several extant climatic periodizations when he penned his famous term. As chairman of the American Geophysical Union's Committee on Glaciers, Matthes was responsible for compiling and introducing annual reports on the condition and alteration of American glaciers, along with providing notice of relevant publications, technological developments, and changes of personnel. Matthes' investigations of the Earth's surface—and, in particular, its glaciers—had convinced him of the reality of climatic variation before he ever published the phrase "little ice-age" in 1939. Writing about the glaciers of Washington's Mount Baker in the previous year's report, Matthes explained that, although "the record of glacial measurements . . . is as yet too short to afford a reliable basis for comparisons," the "data obtained so far justify the belief that in the course of time the recession-record . . . will come to have real value as an index of the trend of climatic fluctuations."[1] Matthes' reference to the value of the recession records that geologists had begun to compile of western American glaciers demonstrated his concern for short-

[1] François Matthes, "Report of Committee on Glaciers, 1937-38," *Transactions of the American Geophysical Union* (1938): 315.

term glacial alteration—not merely that occurring over several millennia, as some have suggested.

Matthes' 1939 report remains his most cited publication. As was suggested in the introduction, though, references to this work have generally been limited to a handful of quotes, thus ignoring significant elements of his argument. From its outset, the 1939 report was unique. Although no longer than its predecessor, its discussion of glacial changes was far more detailed and its conclusions more broadly applicable. Matthes understood that the Committee's work was potentially of interdisciplinary value. The Committee, he wrote, "felt that the maintenance of a continuous record" of glacial variations was "of prime importance, not only to hydrology and glaciology, but, as has become increasingly evident recently, also to climatology, geomorphology, geography, ecology, history, and archaeology."[2] The 1938 report was reflective of the primary tasks to which the Committee was dedicated—the recording and reporting of glacial changes. Matthes expanded the purpose of the 1939 report, however, to include discussion of climatic changes.

Matthes believed in the existence of short, medium, and long-term fluctuations of climate and in the utility of glacial measurements for tracing them. He explained:

> The value of the records obtained is not to be gaged by the variations indicated in any one year, or group of years, for such passing variations reflect merely the effects of short-time fluctuations in precipitation and temperature, and of various local factors as well. Taken collectively, however, in relation to long-time

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[2] François Matthes, "Report of Committee on Glaciers, April 1939," *Transactions of the American Geophysical Union* (1939): 518.

> swings in climatic conditions comprising decades, centuries, and even thousands of years, they are found to possess great significance.[3]

Matthes made no claim for the originality of his suggestions—a point few, if any, historians have recognized. "This fact," he explained, "has long been recognized and, as a consequence, more than one glaciologist has been spurred on to search for data that would permit extension of the plotted curves back into historic times and even farther back into the past."[4]

Matthes identified the publications of several individuals who had been influential in the development of his glacial and climatic theories. First among these were the contributions of Charles Rabot, whose 1915 article has already been addressed. Matthes singled out for discussion Rabot's identification of a period of glaciation beginning in the sixteenth century. "Successful searches made in the archives of the town of Chamonix," Matthes wrote, "notably have served to extend the record for the glaciers of the French Alps back to 1580." These searches had, "for the first time . . . made it clear that the general recession of those glaciers, which has been in progress during the last few decades, set in shortly after the middle of the nineteenth century." Prior to this retreat, Matthes asserted, "there had been an epoch of relatively great glacier-extension that lasted, with minor fluctuations, about 250 years." The "glaciers of the French Alps," were "merely receding back to the positions which they occupied toward the end of the sixteenth century."[5] While Matthes found Rabot alone to be

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[3] Ibid., 518.
[4] Ibid.
[5] Ibid.

particularly influential, Sigurdur Thorarinsson and W. A. Don Munday made significant contributions as well; both contended that a glacial retreat had begun "shortly after the middle of the nineteenth century."[6]

After discussing the climatic changes of the preceding millennium, Matthes turned his attention toward the geological history of glaciers—the subject for which he remains best-known. Matthes made the important assertion that many North American glaciers—particularly smaller cirque glaciers—were the result of relatively recent glacial expansion. This understanding of American cirque glaciers, which form when snow and ice collect in bowl-shaped areas on the side of mountains, was contrary to the popular understanding of the subject. He explained:

> It is commonly assumed that the glaciers now existing on the higher mountains of the Earth are dwindling remnants of the once far more extensive ice-masses of the Pleistocene ice-age. For the ice-caps of Antarctica, Greenland, and Iceland, for the great trunk-glaciers of Alaska and British Columbia, and even for the major ice-streams on such peaks as Mount Rainier, Mount Baker, and Mount Olympus—to limit the discussion to the North American continent—the assumption probably is valid, but that it can not be extended to all of the numerous cirque glaciers that exist at present on the Cascade Range, the Sierra Nevada, and the principal ranges of the Rocky Mountain System within the United States, is now rather definitely indicated by recent studies by the Chairman of this Committee in the Sierra Nevada and the adjacent Owens Valley. These studies, in his opinion, leave little doubt that the fifty-odd cirque glaciers of the Sierra Nevada and, by implication, the hundreds of similar small glaciers on the other ranges mentioned, are not relics of the ice-age but represent a new generation of ice-bodies that came into being less than 4000 years ago—that is, fully 6000 years after the Pleistocene ice-age came to an end.[7]

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[6] Ibid., 519. Matthes used this quotation twice in his comments, once each for Thorarinsson and Munday.

[7] Ibid., 519.

Matthes found this contention to be justified by the work of Ernst Antevs. "The proof" of this "new generation," Matthes asserted, "is found in the Post-Pleistocene history of Owens Lake, as recently reinterpreted by Antevs." The modern iteration of Owens Lake, Antevs had suggested, was a development of the preceding 4000 years. Matthes found this determination to have a wider utility. "The climatic changes during the Post-Pleistocene interval postulated by Antevs," he wrote, "are now well established by several different lines of evidence." This reinterpretation was "supported by what is known of the Post-Pleistocene history of Lake Lahontan and other lakes in the Great Basin."[8] Because lakes like Owens Lake were "fed very largely by the melt-water that flows from the snow-fields and glaciers of the Sierra Nevada," they offered an excellent proxy for measurement of glacial changes. Since "small ice-bodies are very delicately adjusted to the average climatic conditions of the present time," glacial change offered a proxy for climatic change. The delicate circumstances of small glaciers were so great, Matthes explained, that "their life 'hangs by a thread,' so to speak." Because of this sensitivity to climatic change, and because of the proxy of ancient lakes, he concluded that the glaciers of the Sierra Nevada were "in all probability somewhat less than 4000 years old." Matthes did not believe himself to be the first to suggest that these glaciers were of recent formation. The moraines around small cirque glaciers throughout the West already suggested recent glaciation. "The contrast they offer to the nearest moraines that are unquestionably of Pleistocene age," he explained "already has

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[8] Ibid.

suggested to more than one observer that they are perhaps products of recently-formed, 'modern' glaciers."[9]

The period of recent glacial advancement Matthes identified was not limited to a small geographical region; he and the Committee on Glaciers believed it to be a phenomenon of almost-continental proportions. Again in the 1939 report, Matthes contended:

> [E]nough is known to warrant the general statement that in all probability all of the present glaciers on the Sierra Nevada, all those on the ranges of the Rocky Mountain System within the United States—with the possible exception of a few of the largest in Glacier National Park—all of the lesser glaciers on the Cascade Range and on the Olympic Mountains, belong to the "modern" category, and are not relics of the Pleistocene ice-age at all. And probably only the main ice-tongues on Mount Rainier, Mount Baker, and Mount Olympus have persisted since Pleistocene time, the same as the still larger glaciers in British Columbia and Alaska.[10]

Even the larger, Pleistocene-borne glaciers had experienced great alteration in the preceding century. This, when combined with the other evidence collected in the Committee's report, led Matthes to conclude that the preceding four millennia—approximately—represented a distinct geological era. In Matthes' own, now famous, words:

> All of the glaciers of the latter class, however, it is manifest from the relatively large scale of their oscillations during the last 100 years, now have far greater extent and volume than they had during the middle third of the Post-Pleistocene interval, and accordingly it may well be said that we are living in an epoch of renewed but moderate glaciation—a "little ice-age," that already has lasted about 4000 years.[11]

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[9] Ibid., 520.
[10] Ibid.
[11] Ibid.

Many have identified this as the first printed reference to the "Little Ice Age." It was not. The term's first appearance may instead be found in George F. S. Elliot's 1909 *Botany of To-Day: A Popular Account of Recent Notable Discoveries*. Attempting to address climatic and floral change in concert, Elliot wrote:

> It is generally allowed by all continental botanists that after the first and greatest of the Ice Ages, a long period of time ensued during which the climate was hotter and drier than it is to-day. Then followed a distinct relapse into a Little Ice Age, which was by no means so severe as the Great one, but yet cold and wet enough to leave very distinct traces.[12]

No geographer, scientist, or historian has acknowledged Elliot's 1909 reference to a "Little Ice Age." The 1910 and 1911 editions of the volume utilized the same phrase, as well. Whether Matthes was aware of Elliot's work cannot be determined, but it seems unlikely that he would have been unaware of an English publication related to his interests. Matthes, or possibly a colleague on the Committee on Glaciers, may have recalled Elliot's phrase and introduced it—uncapitalized and slightly altered—into the 1939 report. It may be mere coincidence. While it should be recognized that Elliot first used the term "Little Ice Age," it should also be remembered that it was Matthes who popularized it. His work demonstrated a new usage of the label, one in which the lines between ancient and modern were somewhat blurred. He clearly conceived of the epoch as a feature of several millennia, but he also understood that recent centuries were of central importance to its development.

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[12] George F. S. Elliot, *Botany of To-Day: A Popular Account of Recent Notable Discoveries* (Philadelphia: J. B. Lippincott Company, 1909), 226.

Matthes did not offer the idea of the "little ice-age" in passing, as an off-hand remark. Although he did not capitalize the term as he did more established names like "Pleistocene," his usage of quotation marks around the entire term suggests that he understood the period to be a distinct concept. That Matthes believed his identification of a "little ice-age" was important, rather than a comment made in passing, is evidenced by the wide application he anticipated for future studies. Referencing, again, the value of understanding the preceding centuries, Matthes explained:

> The vicissitudes of the glaciers during those 4000 years are recorded, rather obscurely, in their multiple "modern" moraines. The spelling out of that record is still to be done. It is preeminently a task for glacial geologists and will not be enlarged upon here; but as it will serve to link this new chapter of glacier-history right up with the present time, it is nevertheless a matter of some importance to hydrology, climatology, ecology, archaeology, and all the other sciences that reach back into the recent past. Indeed, there already is considerable evidence indicating that the glacier-oscillations of the last few centuries have been among the greatest that have occurred during the 4000-year period, and facts such as these can not be ignored. It is to be hoped, therefore, that this line of research will soon find men willing to engage in it. In Europe a beginning already has been made, but thus far, apparently, without a clear realization that the glacier-oscillations of historic times form part of an essentially new chapter of glacier-history that is separated by a long stretch of time from the "stadial" oscillations that marked the decline of the Pleistocene glaciers.[13]

Matthes had discovered in his own work and in that of others a new avenue for interpreting the past. He corrected misunderstandings about the age of some of the West's most famous glaciers. Most importantly, however, Matthes gave the epoch two elements necessary for popular acceptance: a name, "little ice-age," and an audience, the American Geophysical Union. Much has been made of the differing definitions of

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[13] Matthes, "Report of Committee on Glaciers, April 1939," 520.

the term, one comprising millennia, the other only centuries. Matthes invented neither. He may not have invented the term, either. His invaluable 1939 contribution to *both* of its usages, millennial *and* centennial, however, ensures that the name François Matthes will remain associated with its usage.

Matthes' discovery did not go unnoticed in his own time. For a population accustomed to the belief that its glaciers were remnants of the distant and great ice age, the determination that they were of more recent origin was significant enough for distribution in newspapers of the American West. The April 1939 report itself did not set in motion this reportage; credit instead is due to Matthes' August 1 address to the 1939 Pacific Science Congress in Berkeley, California. The Associated Press distributed a report on the addresses given at this Congress. Newspapers in Ogden, Utah; Modesto, California; and Reno, Nevada, offered prominent attention to the story in their issues of August 1 and 2. *The Modesto Bee* and *The Ogden Standard-Examiner* offered brief and almost-identical four-paragraph reports on the recent glaciation, headlining, respectively, that "Sierra Nevada Glaciers Are Held Mere Youngsters" and "Sierra Glacier is Mere 'Baby.'"[14] The *Reno Evening Gazette* offered the same four-paragraphs, headlined as "Young Glaciers in Mountains," but it also briefly reported on the geological addresses of H. E. Vokes and Ernst Antevs. All three articles colorfully reported that the Sierra

[14] "Young Glaciers in Mountains," *Reno Evening Gazette* (August 1, 1939); "Sierra Nevada Glaciers Are Held Mere Youngsters," *The Modesto Bee* (August 1, 1939); "Sierra Glacier is Mere 'Baby,'" *The Ogden Standard-Examiner* (August 2, 1939).

glaciers "originated about 4,000 years ago as children of a new glacial generation, and are not gray bearded remnants of the Ice Age."[15]

None of the three mentioned the term "little ice-age," suggesting that either Matthes did not use the term in his address or that its usage was not reported by the Associated Press. One of the nation's links to the distant past—glaciers—had been revealed to be of recent origin. Whether or not people found this remarkable because of its variance from the standard accounts of states, adventurers, and authorities, or because it suggested ice ages were more common than once thought, is not apparent from the articles. That it was understood to be an important discovery in the West, however, is evident.

In late 1939 Matthes offered a window into the thought process that led him to suggest the existence of a "little ice-age." Writing for the journal of the Mazamas mountaineering society, Matthes noted that "[f]or a number of years past" he had "been puzzled by the significance of the large and extremely fresh-looking morainal embankments that lie at the fronts of the small cirque glaciers of that range."[16] He had long wondered if it was "possible . . . that they are the products of new ice bodies that were formed relatively recently." Matthes acknowledged that this idea "was not altogether novel," and he cited Israel Russell's 1889 study—addressed here in Chapter IV—as evidence of this. While Matthes found Russell's assertion—that the Sierra glaciers were of relatively recent origin—rather convincing, neither scientist had found

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[15] "Mere Youngsters," *The Modesto Bee*. All three articles used the same language, but each followed slightly different conventions of spelling and punctuation.

[16] François Matthes, "The Glaciers of our Own Time," *Mazama* 21, no. 12 (December 1939): 20.

"definite proof that such had been the course of events."[17] Ernst Antevs' 1938 reinterpretation of the history of Owens Lake provided that evidence. The totality of the evidence Matthes and his colleagues collected in the 1930s suggested the existence of an era of glacial recession followed, after 2000 B. C., by an era of glacial expansion. "When, therefore, we view the matter broadly in this way," Matthes wrote, "it seems, indeed, that there is some justification for saying that we are now living in a "little ice age."[18] Matthes referenced the "little ice age," unhyphenated here, unlike in the Committee reports, several times in the concluding sections of his article. He even sought the assistance of the Mazamas in studying its impact on Mount Hood. Matthes' address to a segment of the public through *Mazama* offers a window into the thoughts that led to his formulation of a "little ice-age," but it also offers further support to the contention that Matthes used the phrase intentionally, definitively, and with the hope that others would adopt it.

The Committee on Glaciers' interest in a rather recent glacial period was not limited to the report of 1939; subsequent reports built upon the groundbreaking conclusions of that well-known report. Study of such variation was one of their primary commitments. The Committee on Glaciers conceived of three key trajectories for glacial research: quantitative measurement of glacial processes, application of new optical technologies to the study of glacier-ice formation, and an "intensive search for data, geomorphologic, climatologic, biologic, archaeologic, and other, that may throw light on

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[17] Ibid., 22.
[18] Ibid., 26.

the history of glacier-variations during the Post-Pleistocene interval."[19] In the 1940 report, the Committee on Glaciers reiterated the conclusions of the previous report, reporting that "[d]ata were obtained that set on a firmer basis than before the tentative conclusions announced in the . . . report of April 1939." The 1940 report is one of the most important reports for historians of the Little Ice Age—the era and the phrase, but it is rarely cited. The data collected by the Committee in the year following the 1939 report supported three assertions:

> (1) The present cirque-glaciers on the Sierra Nevada of California represent a new generation of ice-bodies of late Post-Pleistocene origin, at most 4,000 years old, and now dwindling remnants of the great ice-streams of the Pleistocene epoch. They occupy the cirques that were left empty by the complete extinction of their Pleistocene predecessors during the warm and dry middle portion of the Post-Pleistocene interval.
> (2) The majority, perhaps all, of the cirque-glaciers and tiny glacierets that exist today on the other mountain ranges in the western United States by inference belong to the same new generation.
> (3) The larger glaciers in northern Washington, in Canada, and in Alaska presumably did not melt away entirely during the warm middle third of the Post-Pleistocene interval but were greatly reduced in size. They have reexpanded since then to the limits from which they are even now receding, and as their reexpansion has been of considerable magnitude, to judge from certain specific cases, there appears to be warrant for the assertion that the present age is witnessing a mild recrudescence of glacial conditions—that it is, as a clever journalist has suggested, a separate "little ice-age."[20]

The third statement is particularly remarkable because it suggests two possibilities: either a journalist first applied the term "little ice-age" to the recent past, or Matthes originally drew his term from the work of a "clever journalist." The Committee again made no mention of George Elliot. Matthes neither cited nor identified the journalist,

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[19] François Matthes, "Committee on Glaciers, 1939-40," *Transactions of the American Geophysical Union* (1940): 397.
[20] Ibid., 398.

and the wording of the report, particularly of "the present age," does not make clear whether Matthes was speaking of centuries or millennia. Both usages are possible. The role of this still-unidentified journalist, however, has been recognized by only one publication since 1958: astrophysicist Willie Wei-Hock Soon and Steven H. Yaskell's *The Maunder Minimum and the Variable Sun-Earth Connection*.[21]

Although it is not clear exactly what period of time Matthes was speaking of in the preceding assertions, the 1940 report maintained an emphasis on wide-scale glacial advance after the sixteenth century. Matthes and the Committee on Glaciers believed that this advance had been on a scale unseen in historic times. Matthes explained:

> Whether or no any close synchronism actually exists between individual glacier-maxima of short duration (small peaks on a curve of long-time swings) in the Old World and the New, this much can be asserted with some confidence on the strength of the data now at hand, that throughout the last three centuries the glaciers in Europe and in the western United States were appreciably larger than during the preceding centuries, and their maxima in the seventeenth, eighteenth, and nineteenth centuries were without a doubt the greatest ice-extensions that have occurred since the end of the Pleistocene ice-age.[22]

This assertion, in conjunction with those of 1939 suggestive of "an epoch of relatively great glacier-extension that lasted . . . about 250 years," is evidence that Matthes believed the era between about 1600 and about 1850 to be of central importance to the "little ice-age."[23]

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[21] Willie Wei-Hock Soon and Steven H. Yaskell, *The Maunder Minimum and the Variable Sun-Earth Connection* (Singapore: World Scientific, 2003), 207-09. For the second most-recent publication to reference the "clever journalist," see William S. Cooper, "Terminology of Post-Valders Time," *Bulletin of the Geological Society of America* 69 (July 1958): 942.

[22] Matthes, "Committee on Glaciers, 1939-40," 400.

[23] Matthes, "Report of Committee on Glaciers, April 1939," 518.

George Hanson, it has been already been noted, suggested in 1934 the existence of a period of glacial advance subsequent to the retreat of Pleistocene glaciers. While he published his assertion in the *Transactions of the Royal Society of Canada*, his discovery did not have the same impact as did that of Matthes. Matthes remained unaware of Hanson's research on British Columbia's Bear River Delta until after the publication of the 1939 report. When Matthes discovered that their publications had drawn similar conclusions, he was quick to acknowledge Hanson's research. Matthes first did so in his 1939 article for *Mazama*, but he reiterated his appreciation for Hanson's research in the 1940 report:

> It is a matter of no little interest . . . that only a few years ago almost identical conclusions were drawn by Hanson regarding the Post-Pleistocene extinction and subsequent rebirth of certain small glaciers in British Columbia. That fact, the writer is obliged to admit, had not come to his attention when he was preparing the Committee's report for 1939. He therefore hastens to mention it here, both in order to give Hanson the credit that is due him and in order to stress the significance of the remarkable concordance of Hanson's conclusions and his own.[24]

Matthes was uncertain as to why Hanson's paper had received little notice in the United States. He noted that this ignorance may have been the result of the paper's focus on "an apparently isolated case having perhaps only local significance," but he suggested that it may be "due also to the fact that American glaciologists and geologists thus far have occupied themselves but little with questions relating to the variations of glaciers and of climatic conditions during the Post-Pleistocene interval." Despite the scholarly community's belated recognition of Hanson's discovery, Matthes believed it was worthy

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[24] Matthes, "The Glaciers of our Own Time," 24; idem, "Committee on Glaciers, 1939-40," 402.

of note: "Hanson's conclusions regarding the rebirth of the small glaciers in the Bear River Valley," he wrote, "now suddenly assume considerable importance because of their close concordance with the writer's conclusions regarding the rebirth of the glaciers of the Sierra Nevada."[25]

The Committee on Glaciers' 1940 report extended its focus beyond the American glaciers with which it was usually concerned. Citing European research from the preceding decade, Matthes noted that, between the great ice age and the more recent glaciation, the Alpine "snow-line lay at a correspondingly higher level" and "the glaciers in the Alps were very much smaller than they are now."[26] Although Matthes found European analyses supportive of his conclusions, he did not believe that European scholars had framed their evidence in a way that successfully identified glacial eras. "The first proof of the complete extinction and subsequent rebirth of glaciers," he wrote, "comes from the United States, where a glacier-bearing mountain-range exists in juxtaposition to extensive desert-basins," a juxtaposition where "the Post-Pleistocene history of the glaciers can be checked by that of the snow-fed saline desert-lakes."[27]

Because of its attempt to draw evidence from sources throughout the northern hemisphere, the Committee on Glaciers' 1940 report ought to be considered in conjunction with that of 1939. This has rarely been done. While Matthes again did not capitalize the phrase "little ice-age," setting it off instead with quotations marks, it is clear from his wording of the report that he and the Committee conceived of it as an

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[25] Matthes, "Committee on Glaciers, 1939-40," 402.
[26] Ibid., 402-3.
[27] Ibid., 403.

important concept—a title which they likely wished to see adopted by others. The validity of this contention is suggested by Matthes' usage of the term "little ice-age" four times in the first five pages of this ten-page report. That Matthes used the phrase so frequently, yet continued to do so in lower-case lettering, suggests that criticism of the phrase on the grounds of capitalization is unwarranted. For Matthes, the utility of the name seems to have been separate from its capitalization.

The Committee on Glaciers' 1939 and 1940 reports had an obvious impact on the lexicon of scholars. In July 1941, Ronald Ives made use of the term in an investigation of the origins of human settlement along the Sonoyta River in Sonora, Mexico. "Reference to regional paleoclimatic data, much of it based on the work of Antevs," Ives wrote, "shows the peak of the most recent 'high water' period occurring about 4000 years ago." This peak, he explained, "coincided approximately with the 'Little Ice Age' in the California Sierras." Ives maintained the quotation marks—not unusual even by today's standards—but capitalized the phrase, something even Matthes would not do in later reports for the Committee on Glaciers. Another significant characteristic of Ives' brief usage of the term was the geographical limitation he applied to it. Ives did not speak of a global, hemispheric, or even continental glacial regime; he instead identified it as a "minor ice age" in the "California Sierras."[28] It is difficult to form conclusions from such a brief reference. Even its brevity, however, is suggestive of a warm reception for both Matthes' chronology and terminology.

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[28] Ronald L. Ives, "The Origin of the Sonoyta Townsite, Sonora, Mexico," *American Antiquity* 7, no. 1 (July 1941): 25.

Shortly after the publication of Ives' article on the Sonoyta Townsite, Matthes' impact on geology and climatic terminology was solidified in a speech at the University of Chicago. As part of the Fiftieth Anniversary Celebration of the University, Richard Foster Flint of Yale University delivered a wide-ranging address on "Progress and Problems in the North American Pleistocene."[29] Flint noted that "data supporting the belief in a 'Little Ice Age' beginning only a few thousand years ago in North America have been assembled by Matthes."[30] Flint contended that Matthes' contribution was "important" because "it harmonizes with the climatic record of the last several thousand years in Europe, including the Climatic Optimum, and because it is therefore one of the best evidences we yet possess that major climatic changes were nearly simultaneous on both sides of the Atlantic."[31] Flint awaited future research on this "Little Ice Age," suggesting that its discovery in South America would change the way glaciologists understood the relationship between the Northern and Southern hemispheres. Because of the location and nature of Flint's address, his influence on the adoption of the term was significant. The above quotations, which capitalize the "Little Ice Age," are drawn from an edition of the address published in the fall of 1942. His address, of course, was spoken, making the question of capitalization, in this case, irrelevant; by the time it was published, several other authors had begun capitalizing the phrase.

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[29] Richard F. Flint, "Progress and Problems in the North American Pleistocene" (paper presented at the University of Chicago, September, 1941), in *The Journal of Geology* 50, no. 6 (August-September 1942): 563.

[30] Ibid., 568-69.

[31] Ibid., 569.

The year 1942 saw several mentions of the "Little Ice Age" in text. William Cooper addressed the era in a January article on the vegetation of Prince William Sound, Alaska, and Post-Pleistocene climatic history. As part of a literature review, Cooper quoted Matthes' initial usage of the "little ice-age" from the Committee report of 1939. Cooper's own chronology of climatic conditions in Prince William Sound was very similar to that of Matthes, but he did not use the term "little ice-age" in his summary section on the subject. He hypothesized "that the 'present' (liberally construed) in coastal Alaska is a time of ice expansion on a scale not equalled during many centuries of the past" and "that the high-ice mark of 200 years ago at one point, and of today at another, represent a single major maximum, reaching its crest in different places at slightly different times." The period which preceded this expansion was "perhaps *the* major event of middle post-Pleistocene time."[32] Ronald Ives returned to the concept of the "little ice-age" in the summer of 1942 in an article on human settlement around the Colorado headwaters. Ives utilized the term "Little Ice Age" in a table concerned with the "Late-Pleistocene Chronology of the Monarch Valley," suggesting that it correlated with the "Neva" stage of compound moraines, a stage which had been in effect for 4,000 years.[33] While the conclusions of these authors may have differed slightly from each other and from Matthes, the similarities in their chronologies and the nature of their citations—Cooper cited Ives and, like Matthes, Ernst Antevs and George Hanson—

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[32] William S. Cooper, "Vegetation of the Prince William Sound Region, Alaska: With a Brief Excursion into Post-Pleistocene History," *Ecological Monographs* 12, no. 1 (January 1942): 21.

[33] Ronald L. Ives, "Early Human Occupation of the Colorado Headwaters Region: An Archeological Reconnaissance," *Geographical Review* 32, no. 3 (July 1942): 450.

suggest that geologists and scientists at the beginning of the 1940s were beginning to speak a common language, one in which ideas about the "little ice-age" were undeniably significant.

Matthes returned to the subject of the "little ice-age" in the Committee on Glaciers' 1942 report. The 1942 report, like that of 1940, has been generally ignored in histories of the Little Ice Age. This is particularly disconcerting because some might have found in the report evidence for a more recent "little ice-age." Matthes emphasized that "the world-wide shrinkage of glaciers" then in effect were "not part of a continuous process of deglaciation." The recession was instead "only a brief episode in modern, that is, late Post-Pleistocene glacier history" that "set in no farther back than the 1850's, after one of the greatest glacier-advances that has occurred since the end of the Pleistocene ice-age."[34]

Matthes had often discussed the glacial advances of this recent era, but he had never given it a separate name, identifying it only as one of the strongest phases of the millennial-scale "little ice-age." His choice of words in the 1942 report may, in a small way, be responsible for later scholars' application of the term for specifically recent centuries. Matthes explained the comparatively recent advance:

> That glacier advance was the latest of a series of such advances that have followed one another during the past three centuries and that together comprised the climatic phases of a mild recrudescence of glacial conditions—a separate "little ice-age," that began about 4,000 years ago, after the prolonged warm period, or "climatic optimum," of mid-Post-Pleistocene time.[35]

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[34] François Matthes, "Report of Committee on Glaciers, 1941-42," *Transactions of the American Geophysical Union* (1942): 376.

[35] Ibid., 376-77.

The problem with this statement is that Matthes essentially makes two different arguments in one sentence. In the first half of his statement, he referred to a "series of such advances" from "the past three centuries," identifying them as a "separate 'little ice-age.'"[36] In the second half of his statement, he defined this "little ice-age" as a period which "began about 4,000 years ago." Compared to his previous descriptions of the "little ice-age," in which he addressed recent advances as only a phase in one great advance, this part of his 1942 discussion remains unclear. The lack of clarity suggested by the preceding quotation was not, however, representative of the entire report. After the confusing statement, Matthes quickly returned to the definition of the "little ice-age" as an era comprising several thousand years. Acknowledging, again, George Hanson's 1934 publication on the Bear River Delta, Matthes suggested a "remarkable close parallel" between the glacial "rebirth" in British Columbia and that of the Sierra Nevada Mountains. This "parallelism," he contended, "justifies the broad generalization that probably the majority of the present cirque-glaciers" in western North America "came into being during the 'little ice-age' of the last 4,000 years."[37]

Matthes made one further contribution in 1942 with his work on a textbook of hydrology. Arranged by the National Research Council and published by McGraw-Hill, *Hydrology* was the ninth volume in a series dedicated to informing readers of the status and problems related to various earth-science disciplines. Matthes was responsible for

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[36] Ibid.
[37] Ibid., 377.

the chapter on glaciers. While much of his discussion focused on the mechanics of glaciers, he also dedicated a lengthy section to historical and scientific records of their alterations. Matthes opened this section, titled "Earlier glacier oscillations of the historic period and their relation to the Pleistocene ice age," by noting the Alpine glacial advances that followed the sixteenth century, reaffirming the suggestion that he believed these centuries to be of critical significance. Matthes stated that the "general advance of the glaciers in the Alps that culminated during the 1850's was preceded by several other advances of approximately the same magnitude during the seventeenth, eighteenth, and nineteenth centuries."[38] Again referencing the work of Charles Rabot, Matthes suggested that the "most significant fact" drawn from glacial records was "that toward the end of the sixteenth century the climate of central Europe grew distinctly more severe than it had been before."[39]

Although Matthes was clearer in his definition of the "little ice-age" in the *Hydrology* chapter, the confusing usage of terms evident in the 1942 report was also present in the 1942 textbook. Matthes defined the "little ice-age" as a period of about 4,000 years in the concluding remarks of his chapter, but he also attempted to introduce new terminology into the discussion of historical climatic change.[40] Drawing upon the conclusions of German scholar H. Kinzl, Matthes concluded that the preceding 300 years "comprise[d] really a separate epoch of glacier expansion, a lesser ice age, that

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[38] François Matthes, "Glaciers," in *Hydrology*, ed. Oscar E. Meinzer, 149-219 (1942; repr., New York: Dover Publications, 1949), 204.

[39] Ibid., 206.

[40] Ibid., 214-15.

was preceded by a warm period of considerable duration."[41] Exactly how Matthes expected the uncapitalized, unquoted "lesser ice age" to be received in light of his extant "little ice-age" is not suggested by the text. In light of the definitional changes the next decade would witness, however, it undoubtedly contributed to the further confusion of definitions. The term "lesser ice age" never really took off; by 1949 its definition had been applied to the term "little ice-age."

The interruptions of the Second World War had begun to take their toll on the Committee by the release of the 1943 report, sometimes with tragic results. The November, 1942, death of Max Harrison Demorest, First Lieutenant in the Army Air Corps and advisor on climatic and glacial matters in Greenland, was a significant loss for the Committee, both personally and professionally. Several other members of the Committee were separated from their normal duties in support of the war effort, often because of their topographical and geographical expertise. Nevertheless, Matthes and the Committee pressed on with the task of measuring and explaining glacial processes. "Although the contingencies arising in connection with the present war effort thus operate to deprive the Committee of the active cooperation of its members," Matthes wrote, "its work is by no means stopped." Matthes also noted, with a hint of wonder, that "there is no little satisfaction in the thought that in this crucial epoch the technical

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[41] Ibid., 207.

knowledge and the field-experience of even such highly specialized scientists as glaciologists are of real and very practical value to the armed forces of our country."[42]

During this "crucial epoch" the "little ice-age" continued to be an appealing concept for explaining the nature and history of glaciers of lower elevations. As an idea it allowed for a better comprehension of deglaciation. Rather than having to explain the decline of "ancient" glaciers in light of the relatively moderate climatic changes of the present, glaciologists were freed to discuss the activities of present glaciers in light of present conditions, with less baggage from the distant past. In reference to Alaskan glaciers, Matthes explained that "the concept of the 'little ice age' as a distinct period of glacial activity whose climatic phases occurred during the period of modern history, is most helpful." Here, too, Matthes recognized the importance of the last few centuries in understanding the "little ice age." The concept left "no doubt" that an Alaskan glacier was the "product of a modern glacier-advance—the latest, and one of the greatest, of the several that have occurred during recent centuries."[43]

Matthes noted that the application of the "little ice-age" to Alaska might be premature, but the authorship of this caveat is questionable. Matthes, as Chairman of the Committee, was ultimately responsible for the content of the report and, as such, is credited with quotations not credited to others. The passage at hand, though, contends that "the concept of the 'little ice-age' and of the thermic period that preceded it during the middle part of post-Pleistocene time are based . . . primarily on European data, and

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[42] François Matthes, "Report of Committee on Glaciers, 1942-43," *Transactions of the American Geophysical Society* (1943): 390.

[43] Ibid., 400.

their applicability to distant Alaska therefore may perhaps be questioned."[44] This statement is at odds, however, with Matthes' prior arguments about the inability of European scholars to adequately define the alternating glacial and stadial periods. In the 1940 report Matthes wrote that the "first proof of the complete extinction and subsequent rebirth of glaciers thus comes from the United States, where a glacier-bearing mountain-range exists in juxtaposition to extensive desert-basins."[45] Despite the rather out-of-place caveat, Matthes and the Committee immediately defended the wide applicability of their concept: "The fact recognized by all recent explorers is, however, that the reality of those two contrasting periods is nowhere more abundantly and more impressively attested than in Alaska."[46]

Matthes again returned to the importance of the few centuries prior to his lifetime. The discovery, in the wake of the retreating glaciers, of "unfossilized stumps of such a forest that evidently extended over a vast area and flourished for a long time" offered further evidence of his proposed chronology. These "climax forests," the Committee contended, "must have been in existence continuously for a thousand years at the very least." The findings of the previous year had only strengthened the Committee's confidence in the existence of a "little ice-age." Such findings had done one other thing, though, which had important implications for future historical research. They had reaffirmed, in other locations, that an important stage of the "little ice-age" had taken place in the last millennium. Matthes concluded the report by stating,

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[44] Ibid.
[45] Matthes, "Committee on Glaciers, 1939-40," 403.
[46] Matthes, "Report of Committee on Glaciers, 1942-43," 400.

unequivocally, that "there is thus indubitable evidence, on the one hand, of a moderate recrudescence of glacial conditions for several centuries past, and, on the other hand, of a preceding period of widespread deglaciation and luxuriant forest growth."[47] This recrudescence had within it variations; some glaciers advanced at different times. The Committee strongly believed, however, that European and American glaciers shared a similar "general pattern" of advance and retreat. An important stage of this pattern on both continents, Matthes and his colleagues consistently contended, was that "the last pronounced glacial maximum of the 'little ice-age' occurred at some time around the middle of the nineteenth century."[48]

The Committee report of September, 1944, added little of note to the discussion of the "little ice-age" as a concept, focusing primarily on honoring the life of recently deceased Harry Fielding Reid.[49] For the purposes of the committee, the concept of the "little ice-age" seems to have been, by 1944, recognized as fact. It is referenced only once, in relation to the glaciers of Mount Hood, Oregon, and even there as only a brief note: "As was shown in the report of this Committee for 1941-42 . . . probably all of the lesser glaciers on those peaks originated during the 'little ice-age' of the last few thousand years, and are not remnants of the mighty ice-streams of the 'great ice-age.'"[50] The remainder of the report focused on reports of individual glacier systems, although

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[47] Ibid.
[48] Ibid., 401.
[49] Reid was the "dean of American glaciologists" and the first American to recognize the significance of "secular variations of glaciers" and "the need of their being systematically recorded from year to year." See François Matthes, "Report of the Committee on Glaciers, 1943-44," *Transactions of the American Geophysical Society* (1944): 677.
[50] Ibid., 681.

the Committee did reaffirm its contention that the last, great thrust, the "main advance," of these systems occurred during the latter portion of the nineteenth century.[51] Much of Matthes' initial conceptualization of the "little ice-age," with its crucial, final stage, had been completed; their task in future reports would be to determine the geographical extent of the present glacial recession through the compilation of glacial measurements.

The first authors who utilized Matthes' "little ice-age" terminology in the decade after 1939 defined the age as a period of about 4,000 years. While Matthes' own work on the subject was sometimes confusing, possibly suggesting that the previous 300 years had been a "little" or "lesser" ice age, Matthes was generally quite clear that the recent glacial expansion was only the most important advance in a multi-millennial era of glacial advances. The current concept of the Little Ice Age does not, of course, comprise four millennia. The 1940s, while including the first works to utilize Matthes' concept, also marked the point at which the definition of the Little Ice Age began to transform.

The present research has also demonstrated that belief in the existence of a cool, post-medieval era was already, in 1939, an old concept. Within five years of Matthes' first publication of the phrase, other scholars had adapted and applied the title to a period generally beginning in the sixteenth century and ending in the nineteenth. Before the September 1944 publication of Matthes' report, a British author had already begun using the "little ice age" in a new manner. G. S. Callendar, writing on temperature variations in France during the preceding eight centuries, made several important assertions that

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[51] Ibid., 683.

were, whether he realized it or not, in line with prior attempts to sequence climatic changes. Using the data organized by French scholar Cornelius Easton in 1928, Callendar suggested that "the average winter temperature probably was higher up to about the middle of the 16th century than it has been over most of the subsequent period."[52] After a brief period of "mild winters" in the early eighteenth century, temperatures were "again low." Having identified this cooler period—or pair of cool periods, Callendar noted the recent conclusions of François Matthes. Referencing Matthes' textbook contribution from 1942, he explained that Matthes "has called the period of three centuries from about the middle of the 16th century to the middle of the 19th century "the little ice age" owing to the advanced position of the glaciers during much of this time."[53]

Whether Callendar misread the textbook, was confused by the 1942 report, or simply chose a definition of his preference, cannot be determined. It is unlikely that Callendar would have been unfamiliar with Matthes' prior scholarship. By 1946 all members of the Royal Meteorological Society were expected to be aware of Matthes' work. In a note to the fellows of the Royal Meteorological Society, society president Gordon Manley announced that copies of the 1945 Report of the Committee on Glaciers had reached Britain. He noted that "[s]ome of the earlier work by Dr. Matthes on

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[52] G. S. Callendar, "Variations of Winter Temperature during Eight Centuries," *The Quarterly Journal of the Royal Meteorological Society* 70, no. 305 (July 1944), 221-24, 223; Cornelius Easton, *Les hivers dans l'Europe occidentale* (Leyden: 1928). Callendar cites Easton as "A. Easton."

[53] Callendar, "Variations of Winter Temperature," 223.

American glaciers has already been referred to in this *Journal*, notably by Mr. Callendar." Manley also wrote of Matthes:

> Fellows may also be reminded of the summary in the 1939 report of his extremely interesting findings with regard to the age of the small glaciers in the Sierra Nevada of California. These glaciers became re-established less than 4,000 years ago, that is, following a post-glacial period during which they had completely disappeared.[54]

Manley did not mention the "little ice-age" in his note, but nor did Matthes in the quotations Manley included; Matthes actually referenced the glacial advance after 1600.

While Manley's understanding of the "little ice-age" is not clear from this brief note, his statement that the fellows of the society be "reminded" of the 1939 report suggests that the Royal Meteorological Society and the readers of its journal—G. S. Callendar included—were probably well-aware of Matthes' original usage of the "little ice-age." That some scholars began to use the term differently than it was originally intended was more a result of its easy applicability to an already defined, though unnamed, post-medieval period of cooler conditions. It was probably not the result of any gross misunderstanding of Matthes' intentions. Further evidence supporting this assertion may be found two years later, in 1948, in another of the Society's publications. Gordon Manley, no longer president, weighed in on the subject of climatic change and the "little ice-age" as part of an investigation of temperatures in eighteenth-century Europe:

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[54] Gordon Manley, "Glaciers and climatic change: Some recent contributions," *The Quarterly Journal of the Royal Meteorological Society* 72, no. 312-13 (April-July 1946): 251. Callendar did not actually identify Matthes by name in the 1942 article.

> It appears that what Matthes has called the "little ice age" began in the sixteenth century, and it was signalised in Europe by a considerable advance of glaciers about the period 1570-1610: this is conformable with the tendency for a greater frequency of winds of continental origin in Denmark shown by Tycho Brahe's observations.[55]

Manley's usage of the name "little ice age" is important because it was among the term's first applications to a uniquely modern era. What Matthes thought of this usage is difficult to ascertain. He sent no letters of correction to the *Quarterly Journal* regarding its usage, but he passed away in June, 1948, just as his terminology began to gain traction in studies of climatic change.[56]

This new application was not, however, instantly or universally adopted. Some continued to relate the idea of the "little ice-age" to a longer period, but poor selection of quotations only served to further confuse its definition. A July 1948 publication by Paul B. Sears is an example of this unclear usage of the term. Writing on forests and their relation to the periodization of climate, Sears suggested that the period Matthes described identified with one of the twelve substages of Late Wisconsin glaciation. The substage to which he related Matthes' phase comprised almost a third of 12,000 years—not 300; it also included both warm and cool subphases.[57] The quotations Sears selected from Matthes' report, however, were not specific, and Sears' own discussion could have been easily misinterpreted:

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[55] Gordon Manley, "On the trend of temperature in NW. Europe, 1720-1750," *The Quarterly Journal of the Royal Meteorological Society* 74, no. 319 (January 1948), 119-22, 119.

[56] "Noted Geologist, Author Dies," *Oakland Tribune* (June 22, 1948); "Geographical Record," *Geographical Review* 39, no. 1 (January 1949): 157-58.

[57] Paul B. Sears, "Forest Sequence and Climatic Change in North-Eastern North America since Early Wisconsin Time," *Ecology* 29, no. 3 (July 1948): 331.

> There appear, however, to have been two periods of oscillation. One was "in the region of Cochrane (S. of James Bay)" (Antevs, personal communication). The other has been called by Matthes ('43) the "Little Ice Age" . . . and is described by him as marked by "a moderate recrudescence of glacial conditions for several centuries past," with a final period of retreat beginning in the last century.[58]

Sears therefore reinterpreted the Little Ice Age as a stage comprising both glacial advance and retreat—one of six such stages. The quotations he selected, however, suggest that the Little Ice Age operated on a centennial, rather than millennial, scale.

While Sears continued to utilize Matthes' concept of the "little ice-age" in the traditional sense, others proceeded with the new application of term. Gordon Manley remained primary among these, both in his own articles and in his comments on those of others. His participation in a discussion of an article on climatic change by Hans W:son Ahlmann was one such instance in which Manley helped redefine the term. Ahlmann's article suggested that at least five major climatic shifts had occurred in the preceding 4,200 years. Citing research from the North Atlantic region, he contended that the latest major climatic shift had occurred "about A.D. 1200-1300." This century marked a "climatic deterioration" in which parts of Iceland that had been "cultivated by the early medieval farmers" were "overridden by ice for 600 years," while parts of Greenland suffered from similarly inclement conditions. Evidence from archaeological sites in Greenland seemed enough "to justify the conclusion that at no time since 1400 has the climate been so favourable as it has been since the 1920's."[59] This idea of thirteenth-century climatic change agreed well with the suggestions of geographers like Ellsworth

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[58] Ibid., 327.

[59] Hans W. Ahlmann, "The Present Climatic Fluctuation," *The Geographical Journal* 112, no. 4/6 (October-December 1948): 166.

Huntington. "It may also be worth mentioning," Ahlmann wrote, "that this climatic change coincided with the Mongol invasions westward from Central Asia which gave rise to E. Huntington's well-known theories and all the discussion surrounding them."[60]

Although Ahlmann did not use the phrase "little ice-age" in his paper or in the meeting at which it was read, Gordon Manley referred to it in the discussion which followed the reading. The report of the discussion, published several months after it was held, explained that Manley "illustrated with a lantern slide the possible trend of temperature fluctuations for the period since 1500 in Great Britain." The report's author, Gerald Seligman, noted that the "earlier part of the curve was hypothetical" but suggested that future research could complete it:

> Assuming that the present "Little Ice Age" had lasted about 500 years, and allowing for the known records of the Alpine glaciers in the fifteenth century, historical geographers might well investigate the events of the sixteenth century with a view to obtaining the earlier half of the curves of glacier behaviour and of temperature. They should seek for some rather sudden development in that century, perhaps between 1560 and 1600.[61]

This statement, penned by Seligman in reference to Gordon Manley's comments on Hans Ahlmann's paper, is significant for several reasons. It identified the second half of the sixteenth century as a climatically significant era, an identification that both agreed with the suggestions of prior scholars and anticipated the "revolutionary" suggestions of the 1960s and 1970s. It also served as a further stage in the redefinition of Matthes' "little ice-age." Manley's comfortable application of the term is also significant. He

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[60] Ibid., 166-67.

[61] Gerald Seligman, "The Present Climatic Fluctuation: Discussion," *The Geographical Journal* 112, no. 4/6 (October-December 1948): 193.

referred to it in a rather offhand manner and made no (reported) mention of Matthes' research. Seligman's report, with which Manley apparently had no quarrel, also capitalized the phrase.[62] The usage of the "little ice-age" was clearly undergoing an important transformation.

Manley reiterated in 1949 his assertions from both the 1948 article and the discussion of Ahlmann's article. In another article for the Royal Meteorological Society, Manley stated that a "variety of lines of evidence suggests that the 'Little Ice Age' began possibly as early as 1300 in Iceland, more certainly in the 16th century as regards the Alps." He again referenced the observations made by Tycho Brahe, this time bringing in the contributions of A. Easton, which G. S. Callendar had utilized in 1944. Manley contended that the evidence included within these works suggested "a slight deterioration in the middle or late 16th century."[63] In this publication Manley himself capitalized the "Little Ice Age" and, again, neither cited nor mentioned François Matthes.

Another discussion published in this edition of the Royal Society's journal addressed, in part, the definition of the Little Ice Age. The discussion was anchored by an article on climatic fluctuations by C. E. P. Brooks. Brooks focused on the

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[62] D. J. Schove also weighed in on the subject of the Little Ice Age in the discussion, but his usage of the term is not as easily defined as that of Seligman (or Manley). Schove wondered aloud about a relationship between climatic change and populations of the pilchard, a small relative of the herring: "Was it the last phase of the Little Ice Age that caused, after many centuries of prosperity . . . the failure in the nineteenth century of the pilchards, synchronizing with failure of Cornish tin and copper?" See Seligman, "The Present Climatic Fluctuation: Discussion," 194.

[63] Gordon Manley, "The extent of the fluctuations shown during the 'instrumental' period in relation to post-glacial events in nw. Europe," *The Quarterly Journal of the Royal Meteorological Society* 75, no. 324 (April 1949): 166.

fluctuations that followed the Climatic Optimum of 6,000 B.C. to 3,000 B.C. As part of his contribution to the discussion, Brooks addressed solar and tidal theories of climatic change, including those of Otto Pettersson. The responses to Brooks' initial comments on the causation of short periods of climatic change are remarkable for the variety of causative factors addressed. Dr. Atkinson suggested investigating "biological factors" because "they are very much more unstable factors than any others, and can none the less have far-reaching consequences."[64] Mr. E. Gold agreed that "climatic changes of short period might be due to solely terrestrial causes," but remained interested in changes of a longer period. Lieutenant Commander P. C. Spink speculated on the influence of volcanic eruptions. "May I ask," he responded, "whether intense volcanic activity might have had some effect upon past climates?" Spink suggested, quite accurately:

> The enormous discharges of volcanic dust into the atmosphere over a lengthy period of time would have the effect of reducing insolation which in turn would cause a reduction of mean temperature, thus encouraging the growth of glaciers in normally marginal climates.[65]

P. A. Sheppard was rather wary of much of this reasoning, calling it a "measure of escapism" which affects meteorologists, who generally focus on short periods, when they write of longer periods. While meteorologists generally understood daily and monthly changes to be systematic, it seemed to him that "so-called climatic fluctuations" were often "arbitrarily" thought "to require a *Deus ex machina*, in the form, for example,

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[64] C. E. P. Brooks, "Causes of Climatic Fluctuations," *The Quarterly Journal of the Royal Meteorological Society* 75, no. 324 (April 1949): 174.

[65] Ibid., 179.

of a variable sun, for their explanation."[66] Sheppard argued that understanding climatic change required an approach to climatology that would seek to explain, in greater detail, the workings and interconnections of the entire climatic system by incorporating all terrestrial and extraterrestrial factors. W. G. V. Balchin called for further investigation of an influence that he believed had been infrequently considered: "the possible influence of human actions upon climate." Balchin suggested that "those interested in accounting for climatic change within historic time might find a quantitative investigation of the possible effect of man of much interest" because the preceding centuries had seen "a great increase in the world's population."[67] All of the suggestions forwarded in this historic yet largely forgotten discussion were addressed in subsequent decades; many of these questions have become the foundation of modern climatology.

Other contributions to this historic discussion on climatic change and periodization focused upon the subject of the Little Ice Age. D. J. Schove identified "two marked 'discontinuities' in European temperature trends" which he believed corresponded "to the beginning and end of what has been called the 'Little Ice Age.'" These discontinuities occurred about 1540 and 1890, with an increase first in "the 'continental' element" and later in "the 'maritime' element" of the European climate. Schove found it "convenient to date the beginning of the Little Ice Age at 1540, although warm springs for a decade and warm summers almost until 1590 prevented much glacial

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[66] Ibid., 180.
[67] Ibid., 181.

advance until the end of the sixteenth century."[68] His suggestion of discontinuities in 1540 and 1890 was not, however, a suggestion that the intervening years were of uniform characteristics—a common criticism levied by critics of the Little Ice Age into the twenty-first century.

Rather than define the Little Ice Age as a uniform period, Schove proceeded to establish a pattern of Little Ice Age conditions between 1451 to 1950. Based upon "30-year means of documentary data," Shove suggested a three-phase Little Ice Age broken only by brief lulls and occasional maritime conditions.[69] He separated this period into six distinct phases of climate and, during one phase, three subphases. The period from before 1451 through 1540 was "Pre-Glacial," with "very mild" winters, cooling summers, and a "very maritime" weather type. Following this was the "Little Ice Age, Phase I," which stretched from 1541 to 1680. This stage included three subphases. The first of these, I*a*, began in 1541 and stretched through the 1590s; it exhibited "*Cold*" winters, initially "*Hot*" summers, and a "*Continental*" weather type. Subphase I*b* consisted of initially "*Cold*" winters, "*Cool*" summers, and a "[m]oist, cool" weather type. It lasted from 1591 until 1650, and was followed by subphase I*c*, which exhibited "*Very Cold*" winters, "*Hot*" summers, and a "*Very Continental*" weather type. Schove contended that this tripartite first phase of the Little Ice Age came to a close in 1680 and was followed by a return to the conditions which preceded it. This "interglacial" lasted until 1740, when the "Little Ice Age, Phase II" commenced. Phase II continued until

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[68] Ibid., 175.
[69] Ibid., 176.

1770 and was defined by "*Cold*" winters and a continental weather type. After a lull between 1770 and 1800, these conditions would again predominate in the "Little Ice Age, Phase III," of 1801 to 1890. Schove contended that the Little Ice Age, in general, came to a close in 1890, with a return to mild winters and "Very Maritime" conditions.[70] Gordon Manley responded with particular interest to Schove's periodization of the Little Ice Age. Manley was "much struck" by Shove's "finding evidence of the onset of the Little Ice Age in Europe about 1540."[71]

The year 1949 was pivotal for the study of the Little Ice Age, and not only for the aforementioned reasons. By October of that year, the phrase had appeared in *Parade*, the "Sunday Picture Magazine" widely distributed to more than two million readers via newspapers across the nation, including the *Nashville Tennessean* and the *Washington Post*.[72] Author John Devaney attempted to ascertain whether the weather had grown harsher in an article titled "Is Our Weather Really Changing?"[73] Devaney discussed and dismissed—respectfully—the ideas of people who believed that climatic change was the result of "the TV industry, that atom bomb, cosmic changes, airplanes and Russians," but he also attended to the professional investigations of the subject, including those of Hans Ahlmann. Devaney wondered, in a bolded subtitle: "Are We in a 'Little Ice

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[70] The chronological and climatological definitions quoted in this paragraph were all drawn from a table in Schove's contribution to the discussion. See "Table I" in Brooks, "Causes of Climatic Fluctuations," 176.

[71] Ibid., 181.

[72] John Devaney, "Is Our Weather Really Changing?," *Parade* (October 16, 1949), 6. A brief history of *Parade*, written by the newsmagazine, states: "By the end of 1942, PARADE was carried by 16 newspapers." It also states that its circulation had been "2 million in 1946." See Parade, "A Brief History of PARADE," http://www.parade.com/corporate/parade_history.html (accessed August 24, 2009).

[73] Devaney, "Is Our Weather Really Changing?," 8.

Age'?" Devaney explained that, because some glaciers had retreated miles in only decades, "there are scientists who believe we may be emerging, rather quickly, from a 'Little Ice Age.'" How long the new conditions might last, however, he could not answer; he wrote that it "may be a temporary phenomenon, or it may go on for centuries." To the question he originally posed, of whether the weather was *really* changing, Devaney concluded that "the weather *has* been changing," but he noted that "whether that's good or bad depends on your viewpoint."[74]

The contributions of Schove and Devaney in 1949 should not be ignored or undervalued. Writing for different audiences, each made a significant contribution to the historiography of the Little Ice Age. Schove's periodization was a development in understanding the structure and conditions of the Little Ice Age. Few modern usages of the term attempt to account for the variability of its conditions with the same care as Schove did in 1949. The significance of Schove and Manley's discussion went further, even, than that important contribution because it presented the Little Ice Age free of quotation marks, capitalized, and unattributed. Devaney's colorful article, presented in the front of a popular Sunday newsmagazine, introduced an entirely new audience to terminology which had rarely appeared in news articles. Evidence can be found in both scholarly and popular publications, then, that the definition of the "little ice-age" underwent a significant and rapid alteration after 1939. By 1949, at the latest, the concept of a millennial-scale "little ice-age" had been transformed into one of a post-

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[74] Ibid., 9

medieval Little Ice Age. Only a decade after the name's inception, the centuries-old idea of this cool, historical period finally came into its own.

CHAPTER VII

CONCLUSION

In the introduction it was contended that historians and geographers have misunderstood the way in which ideas of historical climatic regimes have developed. Though most historians did not recognize climate as an important element of narrative or thematic history until the 1960s, the idea that distinct, historically significant periods of comparatively warmer or cooler climates have occurred periodically was not a product of the twentieth century. Evidence of their inclusion in historical, geographical, and philosophical texts may be found in the eighteenth, nineteenth, and twentieth centuries, to say nothing of the early, tentative suggestions made by ancient Greek writers. Once seventeenth-century natural scholars "discovered" the climate and the fact that it might be measured, organized, and even "civilized," as Jan Golinski has suggested, they quickly sought to understand its role in human life and history. Was climate determinative, directly shaping the psychological, physical, spiritual, and social characteristics of a people? Or was its influence constrained by other factors—economic, social, religious, and countless others?

Answers to these questions were not uniform, and those found within published texts reflected an enormous diversity of opinion. The crude determinism sometimes ascribed to climatic theoreticians of the early modern period is not borne out by the generality of the sources. While many writers found climate to be a useful tool, many

others eschewed reductionist explanations. Almost as soon as natural scholars began to wrestle with the influence of climate, they also began to look to the past, both to ensure a more complete understanding and to allow for comparison between different eras. This comparison led some, like Edward Gibbon, to believe that the climate had changed. Some believed it was temporary; others believed there could be no return to prior conditions. Many found historical evidence to be an important element for the construction of climatic chronologies; natural scholars marshaled records of frozen rivers, short series of thermometric measurements, and changes in agricultural practice—particularly viticulture—to support their contentions. In the first decade of the nineteenth century, Henry Robertson went so far as to suggest the existence of a 600-year climatic revolution. The formalization of glacial theories during the nineteenth century added a further element to the mix of ideas concerning climatic change, as did the change in glaciers that accompanied that century's warming trend. The Reverend W. G. Heathman made one of the century's most remarkable discoveries in 1855 when he contended that Alpine records and ruins demonstrated both a glacial advance around 1600 and a subsequent retreat. Climatic change itself made it more difficult to theorize about past climates because climates of the present seemed so markedly irregular.

By the end of the nineteenth century, it was apparent that the climate had changed for the warmer (and some would say better), but it was equally apparent that the preceding centuries were different from those of the Middle Ages. Ellsworth Huntington and Otto Pettersson forcefully argued for the existence of environmentally inclement periods. In 1915 Charles Rabot published an influential article that outlined a period of

predominant—though not uniform—glacial advancement between the end of the sixteenth century and the middle of the nineteenth century. It was not unlike Henry Robertson's original formulation, but it was certainly based upon a firmer evidential foundation. Concomitant with the investigation of historically recent climatic change was the questioning of glacial theories of the past. It had been assumed that the glaciers in the American West were holdouts from the great ice age. Close analysis of lakes in the Great Basin, however, by such scholars as Huntington and Ernst Antevs, suggested that a period of glacial advance had commenced about 4,000 years before present.

When François Matthes set pen to paper to complete the 1939 report of the Committee on Glaciers to the American Geophysical Union, he did so bearing in mind both of these important debates about short- and long-term climatic change. He recognized that the climate had changed sometime after 2000 B.C., but he also recognized that the period's most remarkable era was that of the preceding few centuries, during which glaciers had advanced to their greatest limits since the last ice age. He called the entire period, comprising four-thousand years, a "little ice-age," but he did so mindful of the significance of glacial advances after 1600. The phrase was so evocative, so perfect for explaining climatic change, that it should be no surprise that climatologists, meteorologists, and historians adopted his terminology to describe a period which had been granted no formal name, in either 1808 or 1915. While Hubert Lamb and Emmanuel Le Roy Ladurie popularized the "Little Ice Age" in the mid-twentieth century, they neither invented the idea nor made any claim to have done so. In the decade between 1939 and 1949, the very definition of the "little ice-age" was

transformed by such scholars as G. S. Callendar, D. J. Schove, and Gordon Manley. They remain as worthy of recognition in the historiography of the Little Ice Age as Lamb and Le Roy Ladurie, who were as aware of Manley and Schove as they were of Matthes.[1]

François Matthes was one of America's most important geologists. He should be credited both for his groundbreaking contributions to the nascent field of glaciology and for his skilled leadership of the Committee on Glaciers during a fiscally and personally trying time—the Second World War. He should not be credited with inventing the Little Ice Age. Nor, however, should any other twentieth-century scholar be credited as such. The idea of the Little Ice Age preexisted its discovery by more than a century.

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[1] Emmanuel Le Roy Ladurie, *Times of Feast, Times of Famine: The History of Climate since the Year 1000*, trans. Barbara Bray (Garden City, NJ: Doubleday, 1971), 222-25.

REFERENCES

Adams, John. *A View of Universal History, from the Creation to the Present Time. Including an Account of the Celebrated Revolutions in France, Poland, Sweden, Geneva, &c. &c. Together with An Accurate and Impartial Narrative of the Late Military Operations; and Other Important Events*. Vol. 2. London: Printed for G. Kearsley, 1795.

[Aglionby, William]. *The Present State of the United Provinces of the Low-Countries as to the Government, Laws, Forces, Riches, Manners, Customes, Revenue, and Territory of the Dutch*. Rev. ed. London: Printed by John Starkey, 1671.

Ahlmann, Hans W. "The Present Climatic Fluctuation." *The Geographical Journal* 112, no. 4/6 (October-December 1948): 165-93.

Antevs, Ernst. "Postpluvial Climatic Variations in the Southwest." *Bulletin of the American Meteorological Society* 19 (May 1938): 190-93.

"The Apiary." *Chicago Daily Tribune* (January 13, 1873).

Arago, François. "On the Internal heat of the Globe, and Its Influence on Climates." *The Magazine of Popular Science and Journal of the Useful Arts* 3 (1837): 81-90, 182-94.

"Are the Winters Growing Colder?" *The American Bee Journal* 8, no. 8 (February 1873): 180.

"Art. III." *The Monthly Review* (September 1807): 20-24.

Bell, Robert. "Glacial Phenomena in Canada." Paper read before the Geological Society of America, December 26, 1889. In *Bulletin of the Geological Society of America* 1 (April 1890): 287-310.

Bentley, Richard. "The Folly of Atheism, And (what is now called) Deism: Even with respect to The Present Life. The First Sermon preached March 7 1691/92." In *The Folly and Unreasonableness of Atheism Demonstrated from The Advantage and Pleasure of a Religious Life, The Faculties of Humane Souls, The Structure of Animate Bodies, & The Origin and Frame of the World: In Eight Sermons*. 4th ed. London: Printed by J. H. for H. Mortlock, 1699.

Blodget, Lorin. *Climatology of the United States, and of the Temperate Latitudes of the North American Continent. Embracing a Full Comparison of these with the*

Climatology of the Temperate Latitudes of Europe and Asia. And Especially in Regard to Agriculture, Sanitary Investigations, and Engineering. With Isothermal and Rain Charts for Each Season, the Extreme Months, and the Year. Including a Summary of the Statistics of Meteorological Observations in the United States, Condensed from Recent Scientific and Official Publications. Philadelphia: J. B. Lippincott and Co., 1857.

"Brief Abstracts of Papers." *The American Chemist* 1, no. 3 (September, 1870): 100-104.

"A Brief History of PARADE." http://www.parade.com/corporate/parade_history.html (accessed August 24, 2009).

Brooke, Frances. *The History of Emily Montague*. Vol. 1. London: Printed for J. Dodsley, 1769.

Brooks, C. E. P. "Causes of Climatic Fluctuations." *The Quarterly Journal of the Royal Meteorological Society* 75, no. 324 (April 1949): 172-85.

Callendar, G. S. "Variations of Winter Temperature during Eight Centuries." *Quarterly Journal of the Royal Meteorological Society* 70, no. 305 (July 1944): 221-24.

Carson, Rachel. *The Sea Around Us*. New York: Oxford University Press, 1951.

Cerveny, Randy. "Noah Webster: Lexicographer, Climatologist." *Weatherwise* (July/August 2009): 38-43.

"Change of Climate." *The Weekly Visitor* 16 (April 2, 1833): 134-35.

"The Church and the Mission." *The Church Missionary Intelligencer, A Monthly Journal of Missionary Information* 2 (June 1866): 161-68.

[Clark, D. W.], ed. "New York Literary Correspondence." *The Ladies' Repository* 18 (March 1858): 184-87.

Cooper, William S. "Terminology of Post-Valders Time." *Bulletin of the Geological Society of America* 69 (July 1958): 941-45.

_____. "Vegetation of the Prince William Sound Region, Alaska: With a Brief Excursion into Post-Pleistocene History." *Ecological Monographs* 12, no. 1 (January 1942): 2-22.

Costard, George. *The History of Astronomy, With its Application to Geography, History, and Chronology; Occasionally Exemplified by the Globes*. London: Printed by James Lister, 1767.

"Critical Analysis of the Recent Publications on the Different Branches of Physic, Surgery, and Medical Philosophy." *The Medical and Physical Journal* 20, no. 116 (October 1808): 365-378.

Crosby, Thomas. *The History of the English Baptists, from the Reformation to the Beginning of the Reign of King George I*. Vol. 3. London: Printed for the author, 1740.

Dalyell, John. *Fragments of Scotish History*. Edinburgh: Printed for Archibald Constable, 1798.

Dellon, Gabriel. *A Voyage to the East-Indies: Giving An Account of the Isles of Madagascar, and Mascareigne, of Suratte, the Coast of Malabar, of Goa, Gameron, Ormus, and the Coast of Brasil, with the Religion, Manners and Customs of the Inhabitants, &c. as also a treatise, of the Distempers peculiar to the Eastern Countries*. Translated by J[odocus] C[rull]. London: Printed for D. Browne, 1698.

Devaney, John. "Is Our Weather Really Changing?" *Parade* (October 16, 1949).

Diamond, Jared. *Collapse: How Societies Choose to Fail or Succeed*. 2005. Reprint, New York: Penguin Books, 2006.

Dickens, Charles. "Water Everywhere." *All the Year Round* 4, no. 85 (December 8, 1860): 202-5.

Disturnell, John. *Influence of Climate in North and South America: Showing the Varied Climatic Influences Operation in the Equatorial, Tropical, Sub-Tropical, Temperate, Cold and Frigid Regions, Extended from the Arctic to the Antarctic Circle. Accompanied by an Agricultural, and Isothermal Map of North America*. New York: D. Van Nostrand, 1867.

Draper, Daniel. "Has our Climate Changed?" *The Popular Science Monthly* 1, no. 6 (October 1872): 665-74.

Dunbar, James. "Of the General Influence of Climate upon National Objects." In *Essays on the History of Mankind in Rude and Cultivated Ages*, 207-35. London: Printed for W. Strahan, T. Cadell, and J. Balfour, 1780.

Easton, A. *Les hivers dans l'Europe occidentale*. Leyden: n.p., 1928.

Edwards, Bryan. *The History, Civil and Commercial, of The British Colonies in the West Indies: In Two Volumes*. Vol. 2. Dublin: Luke White, 1793.

Elliot, George F. S. *Botany of To-Day: A Popular Account of Recent Notable Discoveries*. Philadelphia: J. B. Lippincott Company, 1909.

"Europe Growing Colder." *The Monthly Journal: Published by the Brotherhood of Locomotive Engineers* 12, no. 1 (January 1878): 5.

Fagan, Brian. *Floods, Famines, and Emperors: El Niño and the Fate of Civilizations*. Rev. ed. 1999. New York: Basic Books, 2009.

_____. *The Great Warming: Climate Change and the Rise and Fall of Civilizations*. 2008. Reprint, New York: Bloomsbury Press, 2009.

_____. *The Little Ice Age: How Climate Made History, 1300-1850*. 2000. Reprint, New York: Basic Books, 2002.

_____. *The Long Summer: How Climate Changed Civilization*. 2004. Reprint, New York: Basic Books, 2005.

Ferguson, Adam. *An Essay on the History of Civil Society*. Edinburgh: Printed for A. Millar and T. Caddel, 1767.

Flint, Richard F. "Progress and Problems in the North American Pleistocene." Paper presented at the University of Chicago, September, 1941. In *The Journal of Geology* 50, no. 6 (August-September 1942): 563-578.

Fryer, John. *A New Account of East-India and Persia, in Eight Letters. Being Nine Years Travels, Begun 1672. And Finished 1681. Containing Observations made of the Moral, Natural, and Artificial Estate of Those Countries: Namely, Of their Government, Religion, Laws, Customs. Of the Soil, Climates, Health, Diseases. Of the Animals, Vegetables, Minerals, Jewels. Of their Housing, Cloathing, Manufactures, Trades, Commodities. And of the Coins, Weights, and Measures, used in the Principle Places of Trade in those Parts*. London: Printed by R. R. for Ri. Chiswell, 1698.

Fuster, Joseph. *Des changements dans le climat de la France: Histoire de ses révolutions météorologiques*. Paris: Capelle, 1845.

Gale, John. *Reflections on Mr. Wall's History of Infant-Baptism. In Several Letters to a Friend* (1711). In *The History of Infant-Baptism. Together with Mr. Gale's*

Reflections, and Dr. Wall's Defence. Vol. 2. Edited by Henry Cotton, 1-349. Oxford: Oxford University Press, 1862.

de Gasparin, Adrien. *Mémoire sur la culture de l'olivier dans le midi de la France*. 1822.

"Geographical Record." *Geographical Review* 39, no. 1 (January 1949): 146-58.

Gibbon, Edward. *The History of the Decline and Fall of the Roman Empire*. Vol. 1. London: Printed for W. Strahan and T. Cadell, 1776.

Golinski, Jan. "Putting Weather in Order: Narrative and Discipline in Eighteenth-Century Weather Diaries." Paper presented at the William Andrews Clark Memorial Library, UCLA, Los Angeles, CA, May 16, 1998. http://www.unh.edu/history/golinski/paper3.htm (accessed June 27, 2009).

Grove, Jean. *The Little Ice Age*. London: Methuen, 1988.

_____. *Little Ice Ages: Ancient and Modern*. Vol. 1. New York: Routledge, 2004.

Guy, William A. "Two Hundred and Fifty Years of Small Pox in London." *Journal of the Statistical Society* 45, pt. 3 (September 1882): 399-437.

Hanson, George. "The Bear River Delta, British Columbia, and its Significance Regarding Pleistocene and Recent Glaciation." *Transactions of the Royal Society of Canada*, Section IV (1934): 179-85.

Heathman, W. G. *Switzerland in 1854-5: A Book of Travel, Men, & Things*. London: Hope & Co., 1855.

Henry, Robert. *The History of Great Britain, From the First Invasion of It by the Romans under Julius Caesar*. Vol. 1. London: Printed for the author, 1771.

Hitchcock, Edward. *Elementary Geology*. 2nd. ed. New York: Dayton & Saxton, 1841.

Hook[e], [Robert]. "A Method For making a History of the Weather." In *The History of the Royal Society of London, For the Improving of Natural Knowledge*, edited by Tho. Sprat, 173-78. London: Printed by T. R. for J. Martyn, 1667.

Howard, Luke. *The Climate of London, Deduced from Meteorological Observations, Made at Different Places in the Neighbourhood of the Metropolis*. 2 vols. 1818. London: Published by W. Phillips, 1820.

_____. *Seven Lectures on Meteorology*. 1837. Reprint, London: Harvey and Darton, 1843.

Hume, David. *Essays and Treatises on Several Subjects in Two Volumes*. Vol. 1. 1742. London: Printed for A. Millar, 1764.

Huntington, Ellsworth. "The Basin of Eastern Persia and Sistan." In *Explorations in Turkestan: With an Account of The Basin of Eastern Persia and Sistan, Expedition of 1903, under the Direction of Raphael Pumpelly,* 219-315. Washington, D.C.: Carnegie Institution of Washington, 1905.

_____. "Changes of Climate and History." *American Historical Review* 18, no. 2 (January 1913): 213-32.

_____. *Civilization and Climate*. New Haven: Yale University Press, 1915.

_____. "The Climate of the Historic Past." *Monthly Weather Review* 36, no. 11 (November 1908): 359-64.

_____. *The Pulse of Asia*. Boston: Houghton, Mifflin, and Company, 1907.

Hutton, Charles. "Climate." In *A Philosophical and Mathematical Dictionary: Containing An Explanation of the Terms, and an Account of the Several Subjects, Comprised under the Heads Mathematics, Astronomy, and Philosophy Both Natural and Experimental; with an Historical Account of the Rise, Progress, and Present State of These Sciences; also Memoirs of the Lives and Writings of the Most Eminent Authors, Both Ancient and Modern, Who by Their Discoveries or Improvements Have Contributed to the Advancement of Them*, 327-28. Vol. 1. London: Printed for the Author, 1815.

"Iceland." In *Johnson's(Revised) Universal Cyclopædia: A Scientific and Popular Treasury of Useful Knowledge*. Vol. 4. Edited by Frederick A. P. Barnard and Arnold Guyot. New York: A. J. Johnson & Co., 1886.

Ives, Ronald L. "Early Human Occupation of the Colorado Headwaters Region: An Archeological Reconnaissance." *Geographical Review* 32, no. 3 (July 1942): 448-62.

_____. "The Origin of the Sonoyta Townsite, Sonora, Mexico," *American Antiquity* 7, no. 1 (July 1941): 20-28.

Jefferson, Thomas. *Notes on the State of Virginia*. [Paris]: n.p., 1782.

Jones, Philip D. and Raymond S. Bradley. “Climatic variations over the last 500 years.” In *Climate Since A.D. 1500,* edited by Raymond S. Bradley and Philip D. Jones, 649-55. London: Routledge, 1992.

Jones, Philip D., Astrid E. J. Ogilvie, Trevor D. Davies, and Keith R. Briffa. “Unlocking the Doors to the Past: Recent Developments in Climate and Climate Impact Research.” In *History and Climate: Memories of the Future?*, edited by Philip D. Jones, Astrid E. J. Ogilvie, Trevor D. Davies, and Keith R. Briffa, 1-8. New York: Kluwer Academic, 2001.

Knight, Andrew. “Upon the Supposed Change of the Climate of England.” Paper read before the Horticultural Society May 5, 1829. In *A Selection from the Physiological and Horticultural Papers, Published in the Transactions of the Royal and Horticultural Societies, by the late Thomas Andrew Knight, Esq., President of the Horticultural Society of London, Etc. Etc. To Which is Prefixed, A Sketch of His Life*, 307-09. London: Longman, Orme, Brown, Green, and Longmans, 1841.

Lalanne, Ludovic. Review of *Des Changements dans le Climat de la France, Histoire de ses révolutions météorologiques,* by Joseph Fuster. *Bibliothèque de l’école des chartes* 7, no. 1 (1846): 460-466.

Lamb, Hubert H. *Climate, History, and the Modern World*. 2nd ed. London: Routledge, 1997.

Le Roy Ladurie, Emmanuel. *Times of Feast, Times of Famine: A History of Climate Since the Year 1000*. Translated by Barbara Bray. Garden City, N.Y.: Doubleday, 1971.

Lemprière, William. “Lempriere’s Tour from Gibraltar to Tangier, Sallee, Moggodore, &c.” In *The New Annual Register, or General Repository of History, Politics, and Literature, For the Year 1791. To Which is Prefixed, A Continuation of the History of Knowledge, Learning, and Taste, in Great Britain, during the Reign of Queen Elizabeth,* 78-90. London: Printed for G. G. J. and J. Robinson, 1792.

Lincoln, B[enjamin]. “On the migration of Fishes. (Vol. III. P. 176) A letter from the Hon. General Lincoln to the Author.” In *The History of New-Hampshire. Volume III. Containing a Geographical Description of the State; with Sketches of its Natural History, Productions, Improvements, and Present State of Society and Manners, Laws and Government*. Edited by Jeremy Belknap, 454-65. Boston: Belknap and Young, 1793.

Lyell, Charles. *Principles of Geology, Being an Attempt to Explain the Former Changes of the Earth's Surface, by References to Causes Now in Operation*. Vol. 1. London: John Murray, 1830.

Manley, Gordon. "The extent of the fluctuations shown during the 'instrumental' period in relations to post-glacial events in nw. Europe." *The Quarterly Journal of the Royal Meteorological Society* 75, no. 324 (April 1949): 165-71.

_____. "Glaciers and climatic change: Some recent contributions." *Quarterly Journal of the Royal Meteorological Society* 72, no. 312-13 (April-July 1946): 251-54.

_____. "On the trend of temperature in NW. Europe, 1720-1750." *The Quarterly Journal of the Royal Meteorological Society* 74, no. 319 (January 1948): 119-122.

Martin, Geoffrey. *Ellsworth Huntington: His Life and Thought*. Hamden, CT: Archon Books, 1973.

Matthes, François E. "Committee on Glaciers, 1939-40." *Transactions of the American Geophysical Union* (1940): 396-406.

_____. "Glaciers." In *Hydrology*. Edited by Oscar E. Meinzer, 149-219. 1942. Reprint, New York: Dover Publications, 1949.

_____. "The Glaciers of our Own Time." *Mazama* 21, no. 12 (December 1939): 20-26.

_____. "The Little Ice Age of Historic Times." In *The Incomparable Valley: A Geologic Interpretation of the Yosemite*, edited by Fritiof Fryxell, 151-60. Berkeley: University of California Press, 1950.

_____. "Report of Committee on Glaciers, 1937-38." *Transactions of the American Geophysical Union* (1938): 314-20.

_____. "Report of Committee on Glaciers, April 1939." *Transactions of the American Geophysical Union* (1939): 518-23.

_____. "Report of Committee on Glaciers, 1941-42." *Transactions of the American Geophysical Union* (1942): 374-92.

_____. "Report of Committee on Glaciers, 1942-43." *Transactions of the American Geophysical Union* (1943): 389-401.

_____. "Report of Committee on Glaciers, 1943-44." *Transactions of the American Geophysical Union* (1944): 677-83.

Milton, John L. *The Stream of Life on our Globe. Its Archives, Traditions, and Laws, As Revealed by Modern Discoveries in Geology and Palæontology. A Sketch in Untechnical Language of the Beginning and Growth of Life, and the Physiological Laws which Govern its Progress and Operations*. London: Robert Hardwicke, 1864.

_____. *The Stream of Life on our Globe. Its Archives, Traditions, and Laws, As Revealed by Modern Discoveries in Geology and Palæontology. A Sketch in Untechnical Language of the Beginning and Growth of Life, and the Physiological Laws which Govern its Progress and Operations*. London: Robert Hardwicke, 1866; [1872].

The Modern Part of An Universal History, from the Earliest Account of Time. Vol. 8. London: Printed for S. Richardson, T. Osborne, C. Hitch, A. Millar, John Rivington, S. Crowder, P. Davey, and B. Law, T. Longman, C. Ware, 1759.

Meyen, Franz J. F. *Outlines of the Geography of Plants: With Particular Enquiries Concerning the Native Country, the Culture, and the Uses of the Principal Cultivated Plants on Which the Prosperity of Nations is Based*. Translated by Margaret Johnston. London: Printed for the Ray Society, 1846.

"Noted Geologist, Author [François Matthes] Dies." *Oakland Tribune* (June 22, 1948).

Ogilvie, Astrid E. J. and Trausti Jónsson. "'Little Ice Age' Research: A Perspective from Iceland." *Climatic Change* 48, no. 1 (2001): 9-52. In *The Iceberg in the Mist: Northern Research in Pursuit of a "Little Ice Age,"* edited by Astrid E. J. Ogilvie and Trausti Jónsson, 9-52. Dordrecht, The Netherlands: Kluwer Academic Publishers, 2001.

Olmstead, A. T. "Climate and History." *Journal of Geography* 10 (1912): 163-68.

Pelloutier, Simon. *Histoire des Celtes, et particulierement des Gaulois et des Germains, depuis les tems fabuleux, jusqu'à la prise de Rome par les Gaulois*. La Haye: Isaac Beauregard, 1740.

Pettersson, Otto. "Climatic Variations in Historic and Prehistoric Time." *Svenska Hydrografisk-Biologiska Kommissionen Skrifter*; Häft 5 (1914): 1-26.

"Physical and Mathematical. Comprehend'ng Medicine and Surgery, Natural History, Experimental Philosophy, Agriculture, Mechanics, Astronomy, Commerce, Arithmetic, Naval and Military Tactics." In *The New Annual Register, or General Repository of History, Politics, and Literature, For the Year 1806. To which is prefixed, The History of Knowledge, Learning, and Taste, in Great*

Britain, during the Reign of King William III.—Part III. With a Map of India, 309-325. London: Printed for John Stockdale, 1807.

Plot, Robert. *The Natural History of Oxford-shire, Being an Essay towards the Natural History of England*. Edited by Robert Brown. 2nd ed. Oxford: Printed by Leon. Lichfield, for Charles Brome, 1705.

Polehampton, Edward. *The Gallery of Nature and Art; or, A Tour through Creation and Science*. Vol. 4. London: R. Wilks, 1815.

Priestly, Joseph. *Lectures on History and General Policy: To Which is Prefixed, An Essay on a Course of Liberal Education for Civil and Active Life*. Dublin: Printed for P. Byrne, 1788.

Proposals for Publishing the Modern Part of the Universal History. Compiled from Original Writers, by the Authors of the Antient. Which will perfect the Work, and render it A Complete Body of History from the Earliest Account of Time, to the Present. London: Printed for T. Osborne, 1758.

R., R. W. "Observations on the Climate of Italy and other Countries in ancient times." *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science* 17, no. 108 (August 1840): 92-102.

Rabot, Charles. "Récents travaux glaciaires dans les Alpes françaises." *La Géographie* 30 (1914-15): 257-68.

[Raynal, Abbé Guillaume Thomas François]. *A Philosophical and Political History of the Settlement and Trade of the Europeans on the Continent of North America.* Translated by J. Justamond. Vol. 4. Dublin: Printed for William Halhead and John Exshaw, 1776.

Robertson, Henry. *A General View of the Natural History of the Atmosphere, and of the Connection with the Sciences of Medicine and Agriculture; Including an Essay on the Causes of Epidemical Diseases*. Edinburgh: Printed by Abernathy and Walker, for W. Laing, A. Constable and Co. and W. and J. Deas; and for Cadell and Davies, and Longman, Hurst, Rees, and Orme, 1808.

"Robertson's *General View of the History of the Atmosphere*." *The Literary Panorama, Being a Review of Books, Magazine of Varieties, and Annual Register; Comprising Interesting Intelligence from the Various Districts of the United Kingdom; The British Connections in the East-Indies, the West Indies, America, Africa, Western Asia, &c. and from the Continent of Europe, Austria, Denmark, France, Germany, Greece, Holland, Hungary, Italy, Poland, Portugal, Prussia, Russia, Spain, Sweden, Turkey, &c*. 5 (March 1809): 1123-1131.

Ruddiman, William F. *Plows, Plagues, and Petroleum: How Humans Took Control of Climate*. Princeton: Princeton University Press, 2007.

Russell, Israel C. "Quaternary History of Mono Valley, California." In *Eighth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1886-'87*. Washington, D. C.: Government Printing Office, 1889.

S. "Notices of the Seasons in Olden Times." *The Farmers' Register, a Monthly Publication, Devoted to the improvement of the Practice, and Support of the Interests of Agriculture* 4, no. 4 (August 1836): 247-50.

Sears, Paul B. "Forest Sequence and Climatic Change in North-Eastern North America since Early Wisconsin Time." *Ecology* 29, no. 3 (July 1948): 326-33.

Selden and Whitehead. "A short History of the Yellow Fever which prevailed at Norfolk in the Months of August, September and October, 1801; with some Account of the Diseases that preceded and followed its Appearance. Communicated by Drs. Selden and Whitehead, in a letter to Dr. Miller, dated Norfolk, July 15, 1802." In *The Medical Repository, and Review of American Publications on Medicine, Surgery, and the Auxiliary Branches of Science*. Vol. 6. Edited by Samuel L. Mitchill and Edward Miller, 247-53. New York: Printed by T. & J. Swords, 1803.

Seligman, Gerald. "The Present Climatic Fluctuation: Discussion." *The Geographical Journal* 112, no. 4/6 (October-December 1948): 193-95.

[Short, Thomas]. *A General Chronological History of the Air, Weather, Seasons, Meteors, &c. in Sundry Places and different Times; more particularly for the Space of 250 Years. Together with some of their most Remarkable Effects on Animal (especially Human) Bodies, and Vegetables.* Vol. 1. London: Printed for T. Longman and A. Millar, 1749.

"Sierra Glacier is Mere 'Baby.'" *The Ogden Standard-Examiner* (August 2, 1939).

"Sierra Nevada Glaciers Are Held Mere Youngsters." *The Modesto Bee* (August 1, 1939).

Smellie, William. *Philosophy of Natural History*. Edinburgh: Printed for the Heirs of Charles Elliot and C. Elliot and T. Kay, T. Cadell, and G. G. J. and J. Robinsons, 1790.

Soon, Willie Wei-Hock, and Steven Yaskell. *The Maunder Minimum and the Variable Sun-Earth Connection*. Singapore: World Scientific, 2003.

Sprat, Tho. *The History of the Royal Society of London, For the Improving of Natural Knowledge*. London: Printed by T. R. for J. Martyn, 1667.

St. John, Henry, Lord Viscount Bolingbroke. *Letters on the Study and Use of History*. 1738. Reprint, London: Printed for A. Millar, 1752.

Taber, Charles A. M. *The Causes which Produce the Great Prevailing Winds and Ocean Currents, and Their Effects on Climate*. Boston: D. Clapp, 1881.

_____. *How the Great Prevailing Winds and Ocean Currents are Produced, and How They Affect the Temperature and Dimensity of Lands and Seas*. Boston: A. Williams & Co., 1882.

Upham, Warren. "Recent Fossils near Boston." *The American Journal of Science* 43, no. 255 (1892): 201-09.

Varney, James. "New Orleans' restoration to end with statue's fingers, Hughes says." *The* [New Orleans, La.] *Times-Picayune* (October 7, 2005).

Walford, Cornelius. *The Insurance Cyclopædia: Being a Dictionary of the Definition of Terms Used in Connexion with the Theory and Practice of Insurance in All its Branches: A Biographical Summary of the Lives of All Those who Have Contributed to the Development and Improvement of the Theory and Practice of Insurance: Whether as Author, Manager, Actuary, Secretary, Agency Superintendant, or Otherwise. A Bibliographical Repertory of All Works Written upon the Subject of Insurance and its Associated Sciences: An Historical Treasury of Events and Circumstances Connected with the Origin and Progress of Insurance Founded in Great Britain, from the Beginning. And Also Containing a Detailed Account of the Rise and Progress of Insurance in Europe and in America. And a Compendium of Vital Statistics.* Vol. 1. London: Charles and Edwin Layton, 1871.

Wall, William. *A Defence of the History of Infant - Baptism Against the Reflections of Mr.* Gale *and Others. With An Appendix containing the Additions and Alterations in the Third Edition of the History of Infant - Baptism, that are most Material*. London: Printed for R. Bonwicke, T. Goodwin, J. Walthoe, S. Wotton, S. Manship, R. Wilkin, B. Tooke, R. Smith, and T. Ward, 1720.

_____. *The History of Infant-Baptism. Being An Impartial Collection of all such Passages in the Writers of the Four first Centuries as do make For, or Against it. Part 1*. 2nd ed. London: Printed by Joseph Downing for Richard Burrough, 1707.

Wallis, W. D. “Geographical Environment and Culture.” *Social Forces* 4, no. 4 (June 1926): 702-08.

Webster, Noah. “On the Supposed Change in the Temperature of Winter.” Paper read before the Connecticut Academy of Arts and Sciences, 1799. In *A Collection of Papers on Political, Literary, and Moral Subjects*, 119-48. New York: Webster & Clark, 1843.

Whitehead, Charles. “Fruit-growing in Kent.” *The Journal of the Royal Agricultural Society* 13 (1877): 92-121.

Whitney, J. D. *The Climatic Changes of Later Geological Times: A Discussion Based on Observations Made in the Cordilleras of North America*. Cambridge: University Press, 1882.

Williams, John. *The Climate of Great Britain; or Remarks on the Change It Has Undergone, Particularly within the Last Fifty Years. Accounting for The Increasing Humidity and Consequent Cloudiness and Coldness of our Springs and Summers; With the Effects such ungenial Seasons have produced upon the Vegetable and Animal Economy. Including Various Experiments to Ascertain the Causes of Such Change. Interspersed With numerous Physiological Facts and Observations, illustrative of the Process in Vegetation, and the Connection subsisting between the Phenomena of the Weather and the Productions of the Soil*. London: Printed for C. and R. Baldwin, 1806.

[Williamson, Charles]. “Letter 5.” In *Description of the Genesee Country, its rapidly pregressive Population and Improvements; in a Series of Letters, from a Gentleman to his Friend*. Albany: Loring Andrews and Co., 1798, 35. Quoted in “Art. I.” *The Medical Repository*, 427-33. Vol. 2. New York: Printed by T. & J. Swords, 1799.

Williamson, Hugh. *Observations on the Climate in Different parts of America, Compared with the Climate in Corresponding Parts of the Other Continent. To which are Added, Remarks on the Different Complexions of the Human Race; with Some Account of the Aborigines of America. Being an Introductory Discourse to the History of North Carolina*. New York: Printed by T. & J. Swords, 1811.

“Young Glaciers in Mountains.” *Reno Evening Gazette* (August 1, 1939).

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